JULY 1949

Plant Engineering

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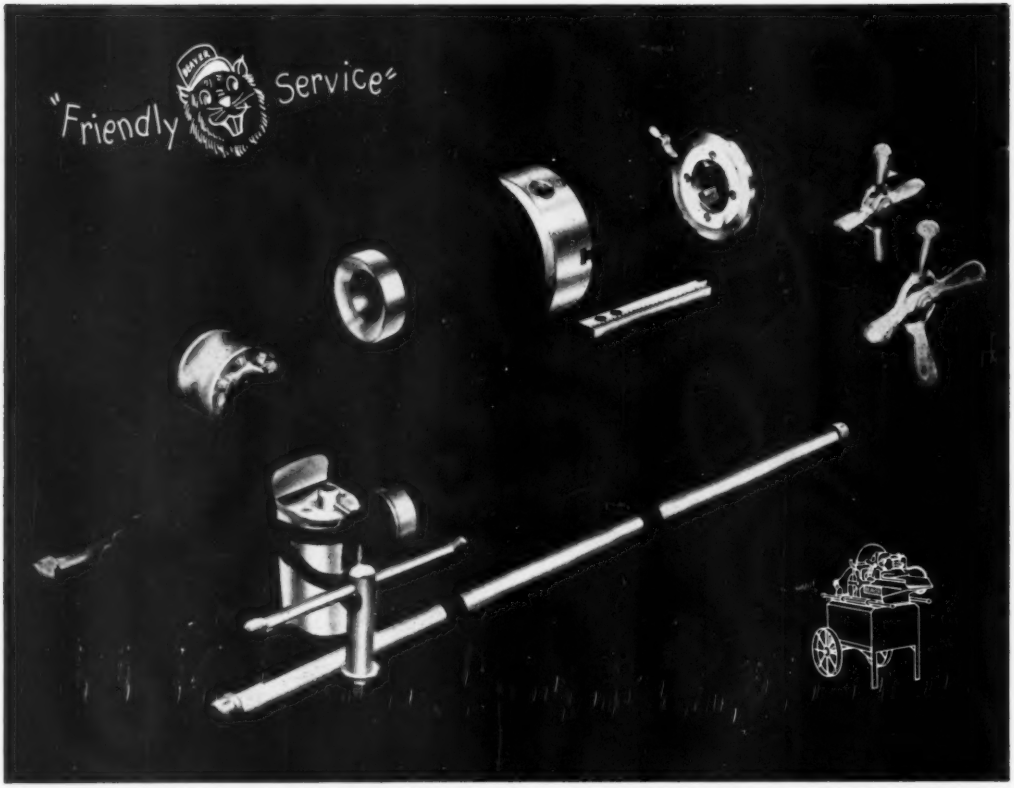
Volume 3, No. 7

The magazine that helps plant engineers with their everyday problems



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For 17 years Model-A Beaver Pipe and Bolt Machine has proved its worth, cut costs and increased output. Excerpts from hundreds of users' letters show you what we mean:

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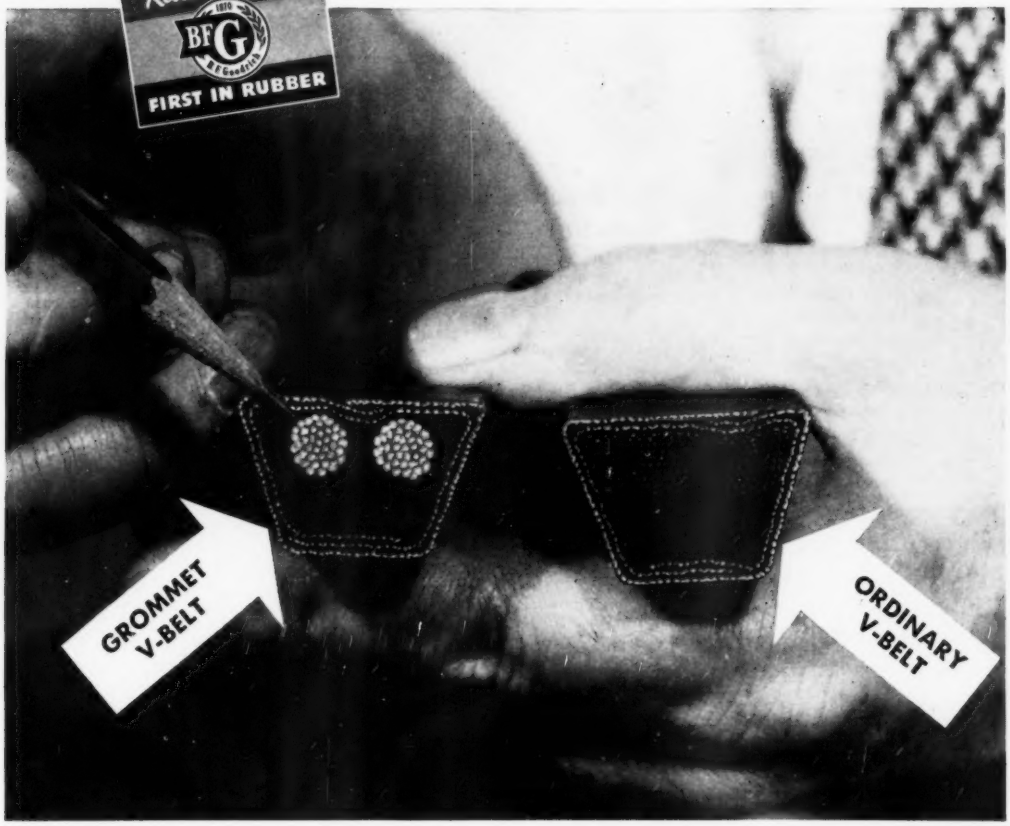

20 to 50% more V-belt value at no extra price

Exclusive B. F. Goodrich grommet construction cuts belt costs

B. F. GOODRICH grommet V belts are actually a premium belt at *no extra price*, because they deliver more horsepower and outlast ordinary V belts of the same size. Grommet construction (U. S. Patent No. 2,233,294) is the reason these belts give you more for your V-belt dollar.

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Twin grommet construction is a B. F. Goodrich "exclusive". Now made in D and E sizes only. To make sure you get genuine grommet V belts, see your local distributor. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Grommet V Belts BY

B.F.Goodrich

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'Round About with the Editors

Plant Engineers, Please Write

"THE ARTICLES appearing each month in PLANT ENGINEERING have been very helpful to me in handling numerous problems — materials handling, maintenance of shop equipment, preservation of machine tools and installations of new equipment.

"If you could devote an issue to a list of plant engineers and their company affiliations I am sure such a list would be valuable to the profession in starting a Society of Plant Engineers. I would like to hear from Plant Engineers along this line."

Edward F. Sullivan, Plant Engineer, San Francisco Naval Shipyard, San Francisco 24, Calif.

The fact that lists of readers are a publisher's stock-in-trade prevent us from publishing such a list. We do believe, however, that Plant Engineering Associations are of great benefit to the profession and we urge that other plant engineers, particularly those on the West Coast and especially those in the San Francisco area, get in touch with Mr. Sullivan. The plant engineers' groups in Boston and New York (See PLANT ENGINEERING, *page 40, June, 1949) have demonstrated the value of such organization to both the company and the individual.—Editor*

Exchanger Practice at Lee

Contributed by F. Leopold, Ch. E.

WE READ with interest Mr. Levine's article, "Heat Exchanger Costs, Selection and Maintenance," in the April issue. Here at Lee Rubber & Tire Corp. we use a number of heat exchangers for a variety of purposes and some are very effective in reducing our costs; we use the internal floating head type almost exclusively. Briefly, they are used for the following purposes:

In our boiler plant we have an open feedwater heater but on continuous blowdown two heat exchangers are used. For the generation of hot water for sanitary use we have a heat exchanger of the type mentioned above.

Throughout the plant where hot water is required in small quantities for specific purposes we use, if the volume permits such practice, small heat exchangers of the floating head type are in use.

These have to be selected on the basis of the cleanability of the tubes through which water passes, as they are generally fed with untreated water, which averages about 150 ppm of calcium hardness. As a result, for ease in cleaning, we have standardized on 1 in. tubes and infrequent cleaning of the tube surface is required. The heating medium, however, for this first stage, is exhaust from hydraulic pumps and of waste water from the plant which is liable to be contaminated with oil. As we do not care to pump this back to our boilers we utilize this heat exchanger for removing the heat from the water before disposing of it to waste.

There is a connection from this heater which goes through an oil separator and exhaust steam, if any, these units are cleaned when the need is indicated by drop in outlet temperature. In the tire vulcanizers, water under 250 psi and at 315 F is used for inflating the tires in the mold and this water is heated in three stages.

First, the cold water passes through a heat exchanger where its temperature is built up from approximately 70 F to 130 F this takes place ahead of the pressure pump. The water is softened so that only passes from there to our feedwater heater.

In second stage this water passes through another heat exchanger where its temperature is built up to about 170 F or 180 F utilizing as the heating medium the discharge from the tire curing process which is contaminated with sulphur derivatives and hence cannot be returned to the boilers.

This waste also might contain other contaminants such as serial tins, scale from the tire press and some small amount of rubber. This heat exchanger has to be cleaned out, on the shell side, about every six months. A large trap is provided ahead of the heat exchanger to catch any scale or other foreign material. This trap is cleaned out daily but still a small amount of scale does get through and this makes necessary the cleaning of the exchanger. Here again we know when it is time to clean the exchanger by the lowering of the temperature of the outlet water.

(Continued on page 42)

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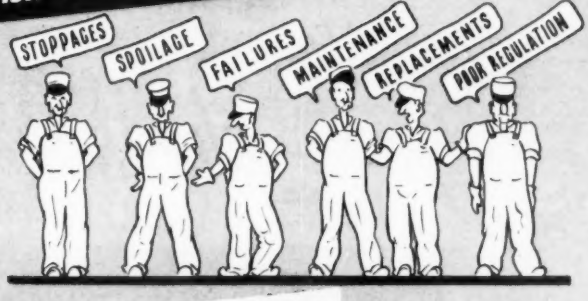
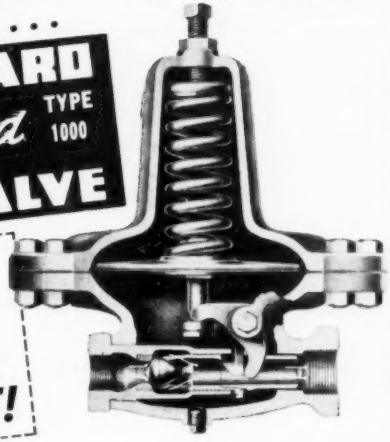
THESE ARE THE TROUBLEMAKERS YOU WISH TO STOP . . . .

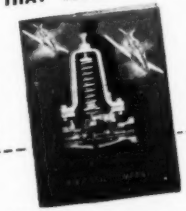


HERE IS THE VALVE THAT WILL STOP THEM . . . .

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000



THIS IS THE BULLETIN (No. 962) THAT TELLS YOU WHY . . . .



SEND FOR IT!

and here is proof from a user . . . .

"We are more than satisfied with our STREAMLINED Valve performance. They are all over this plant and, frankly, I have forgotten about most of them as I never have any trouble.

"What I like about these valves is that in some cases our initial pressures vary considerably, yet the reduced pressure is held steady. This work is all processing and is very important.

"Your competitors will have a hard time convincing me there is a better valve to be had."

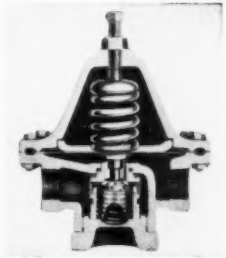
THESE ARE THE BENEFITS YOU GET BECAUSE OF ITS ASPIRATOR AND STREAMLINED FLOW . . . . .

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

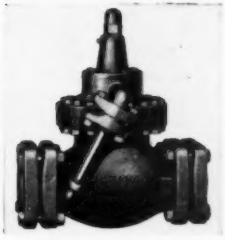
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

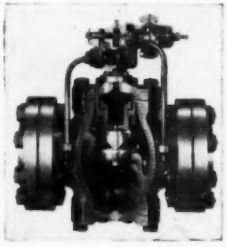
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



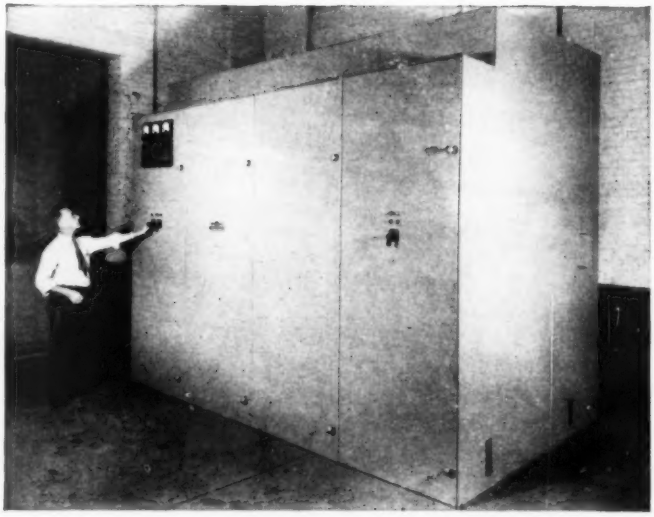
Bulletin 986—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

ENGINEERS The Balmar Corporation MACHINISTS
BALTIMORE, MARYLAND

Manufacturers of Railroad Equipment

chooses

G. H. Slater, Plant Engineer of the Balmar Corp., inspects the General Electric 15-kv Type MI-6 metal-clad switchgear. Section lineup (left to right): Incoming line breaker, potential transformers, Power Co. metering, arc furnace feeder. Future plans call for two sections to be added to the right, one to the left, of the existing unit. Note neat appearance of metal-clad unit—it's space saving, too, and the metal-clad construction offers operating safety to personnel. And the three new sections will be added—when they are needed—with a minimum of fuss, bother, and expense.



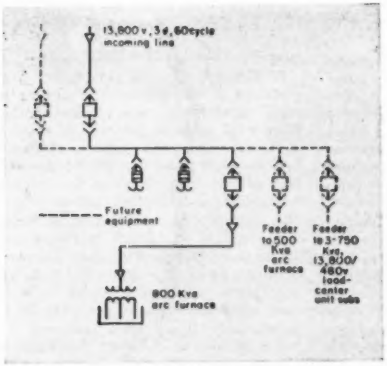
Door of No. 1 compartment of metal-clad unit swung open showing magne-blast air circuit breaker (1200 amperes, 250,000 kva interrupting rating) in operating position. Magne-blast breakers are designed with adequate "IC" (Interrupting Capacity) for short circuit protection, are easily removed for inspection. Instruments and relays are co-ordinated for positive protection of high-voltage feeders.

OBSOLETE

OBSOLETE

This old equipment was considered hazardous and deficient for present duties. Note dangerous, "spider-work" construction. Obsolete oil breakers of inadequate "IC" were seriously overloaded; in case of a bad short circuit could have exploded in a shower of flaming oil.

Metal-Clad Switchgear


13,800 v, 3 ϕ, 60 cycle incoming line
Future equipment
Feeder to 500 Kva arc furnace
Feeder to 3-750 Kva, 13,800/480v load-center unit subs
800 Kva arc furnace

Here's the one-line diagram showing the initial phase of changing over from 25 to 60 cycles at Balmar's Baltimore plant. General Electric 15-kv Type M1-6 metal-clad switchgear handles the incoming 13.8 kv through magne-blast air circuit breakers of 250,000 kva interrupting rating. Future plans call for another incoming line section, plus two more feeders.

The Balmar installation is a complete General Electric project—one source of responsibility, plus the very best in planning, engineering, manufacturing, and servicing facilities to give maximum savings and efficiency to the customer.

SEND FOR THESE HELPFUL BULLETINS

GEA-3083	Metal-clad Switchgear
GEA-4966	Low-voltage Metal-enclosed Switchgear
GEA-3592	Load-center Unit Substations
GEA-3758	Load-center Power Distribution
GEA-4507	Interlocked-armor Cable for Primary Circuits
GEA-4352	Flamenol Cable for Secondary Circuits

—*here's why . . .*

"As a part of our long-range plan of replacing old 25-cycle with new 60-cycle equipment we wanted completely metal-enclosed units to help eliminate danger to operating personnel. Our figures proved it was more economical to purchase a complete unit rather than a 'knocked down' substation. The cost of installing this metal-clad unit was negligible."

G. H. SLATER, PLANT ENGINEER, BALMAR CORP.

The Changeover at Balmar will continue over a period of years. This means only a small part of the total system capacity will be required during the early stages. A problem like this is easily solved with the General Electric load-center power distribution system that Balmar is using—it permits the installation of equipment as it is needed, and allows the over-all program to be accomplished in successive steps. This feature eliminates the necessity for tieing up large amounts of capital in equipment that would not be used to capacity for years to come.

The First Unit Installed was only large enough to handle its own load, plus a nominal margin for continuing the changeover program. As other units are added, this reserve becomes available for normal plant expansion and at no time will there be any large amount of unused capacity.

Modern Industrial Power distribution systems using G-E switchgear and load-center unit substations are applicable to any industrial plant or commercial building where you want full-voltage conditions for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs. A complete system, using G-E switchgear and load centers, costs you less than a "piece-meal," makeshift affair.

Investigate Today the many advantages of using General Electric switchgear and load-center unit substations in *your* plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—and write for the helpful bulletins listed at the left. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

Plant Engineers' Digest

Electric Braking of Induction Motors

ACTUALLY, the induction motor is more a brake than it is a motor although it is used more frequently as a motor. More common electric braking methods for induction motors are plugging, regenerative braking, capacitor braking, and d-c dynamic braking.

Braking is obtained when the torque and speed are of opposite signs. Braking is thus obtained for all negative speeds and positive speeds greater than synchronous. Operation in the negative speed range is called plugging and operation at a positive speed greater than synchronous is called regenerating.

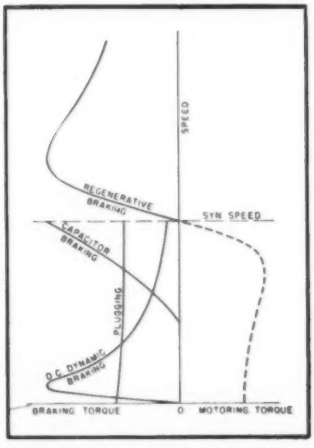
Plugging is widely used because of the simplicity of the control and the large amount of braking torque that is obtained. In order to plug a three-phase motor all that is required is to reverse two of the three primary connections.

Regenerative braking is obtained above synchronous speed. Regenerative braking has the advantage of supplying high braking torque with relatively small loss in the motor. Power current is delivered to the line by the induction machine acting as an induction generator, however, excitation for the motor must be supplied by the line. It is apparent that a disadvantage of regenerative braking is the absence of braking torque below synchronous speed.

Capacitor braking is a form of regenerative braking and is obtained by disconnecting the induction motor from the line and connecting capacitors across the motor terminals. Load resistors are sometimes connected across the motor terminals. Braking can be obtained by connecting capacitors across one, two or all three of the phases. More consistent results are obtained with the capacitors across two or three phases.

High maximum torques can be obtained with d-c dynamic braking and at the expense of relatively little motor heating. The torque obtained falls off rapidly at high speeds for motors of normal slip making it necessary to use a high d-c exiting current if a fast stop is necessary. The scheme has the advantage of providing braking torque down to zero speed without danger of the motor reversing.

The characteristics of the various types of electrical braking are summarized in the curve. Plugging provides good braking torque down to zero speed but the motor suffers high losses and will reverse if it is not disconnected from the line when it reaches zero speed. Regenerative braking provides good torque with low motor losses, however, no braking torque is obtained below synchronous speed. Capacitor braking results in low motor losses. The torque falls off rapidly with speed and it is usually not practical to attempt to brake below one-third of synchronous speed. D-C dynamic braking also results in low motor loss, however, the torque decreases rapidly at high speeds for motors of normal slip. A d-c power supply and a time delay relay to remove the d-c excitation at zero speed is required. *From a paper presented by L. W. Herchenroeder, Westinghouse Electric Corp., before Machine Tool Forum in Buffalo.*



Characteristics of the various types of electric braking are shown in this curve

Trained Minnows Help in Waste Disposal

ONE OF THE most troublesome problems in waste disposal is found in the elimination of phenol. Extremely low concentrations of phenol—as low as one part in a billion—can impart an unpleasant taste to water particularly after the water is chlorinated. The chlorphenols resulting from this union are more offensive than phenol itself. Thus, plants using phenol in any form must be extremely careful of their wastes to make certain that none will find their way into a potable water supply.

A method of detecting extremely small quantities of phenol has recently been found through the use of trained minnows. The Bluntnose minnow reacts to water containing phenol and does so at a faster rate than any known chemical method of detection, and at concentrations lower than those which can be tasted by humans. It is reported that these minnows are trained to expect food whenever phenol is introduced into the aquarium. When they smell the presence of phenol they rush toward the place where they have customarily found food. Perhaps a way can be found to make them ring bells or flash lights.—*From Vol. 18, No. 5, The Betz Indicator, a publication of W. H. & L. D. Betz, Gillingham & Worth Sts., Philadelphia 24.*

Suggestions for Duct Fire Safety

FIRES STARTING in accumulated deposits in ducts are reported almost daily. Most are confined to the duct system but are generally out of reach and difficult to extinguish. Usually the damage ties up important processes and stops production. Occasionally fire spreads beyond the ductwork and causes even more extensive damage.

The following check list presents suggestions for duct fire safety:

I. Use safe duct construction

1. Construct ducts of heavy-gage metal or other non-combustible materials (preferably with locked rather than with soldered joints.) 2. *Provide sufficient removable panels or cleanouts to insure adequate inspection, cleaning, and fire fighting.* 3. Provide adequate separation, or insulation, between ducts and combustible construction or building contents. 4. Keep ductwork and stacks outside of building wherever possible, especially where contents are susceptible to water damage. 5. Keep duct systems separate from each other, particularly those from different fire areas or having different fire hazards. Use a number of small systems rather than a single large system. 6. Install automatic-closing dampers in ducts where they pierce fire walls, and to help prevent spread of fire through large systems in a single fire area.

II. Keep ducts clean

7. *Inspect and clean ducts and fans according to a regular schedule, which should be frequent enough to prevent deposits from building up to dangerous proportions.* 8. Keep rate of deposits as small as possible by proper regulation of process, use of water sprays, filters, condensate traps, settling chambers, etc. 9. Design waste disposal ducts so that all portions will be blown clear.

III. Eliminate sources of ignition

10. Design and operate equipment to prevent high duct temperatures, or introduction of flames into ducts. 11. Prevent electrical, frictional or combustion sparks by careful maintenance of equipment. 12. Locate fan motors outside of ducts. 13. Strictly prohibit such practices as the discarding of cigarette butts or waste paper into duct openings. Screen duct openings where practical. 14. Be sure that ductwork is perfectly clean before permitting cutting or welding.

IV. Install fire protection where needed

15. Provide internal fire protection in large ducts at paint ovens, dry-type

Storm Sash on Mass Production with AMERICAN MONORAIL

"Hang-on" station with upper level track over the cleaning and painting operations shown in background.

Trolleys travel to dipping station where air-powered drop section lowers carriers to floor-level paint tank.

Finished sash travel through oven on monorail tracks which extend through rear door to stock bank.

● A well-known manufacturer of steel office furniture has successfully undertaken mass production of screen and storm sash. A continuously operated finishing department, with a capacity of 80 storm sash and component parts per hour, is made possible by a 300 foot manually operated American MonoRail Overhead Handling System. Of a staff of 60 personnel, only 5 are required in the finishing department. The American MonoRail system transports all the pieces from cleaning and priming tanks to paint dipping vats to ovens to storage. Manual operation was chosen because of the diversity in size and shape of the pieces being finished.

From the simplest hand-operated unit to the most complicated fully automatic system, American MonoRail engineers can suggest a system best suited to **YOUR** problems.

SEND FOR BULLETIN C-1, a 56-page book showing successful applications of American MonoRail Systems.

THE AMERICAN MONORAIL COMPANY

13123 ATHENS AVENUE **CLEVELAND 7, OHIO**

spray booths, and similar processes where rapid accumulation of flammable deposits is likely. The urgency for protection depends upon (a) the size and importance of the duct system and (b) the fire hazard. 16. Select the type of protection most suitable to meet individual conditions. Automatic sprinklers, manually controlled open sprinklers, water spray, steam, carbon dioxide, foam, and dry chemical all have certain applications. Protect important fan housings, in addition to ductwork. Where water is used, give consideration to its safe disposal. 17. Install photoelectric smoke detecting equipment for large air conditioning ducts, particularly where there is the possibility of a panic or of heavy smoke damage. Wire the equipment to sound an alarm or actuate dampers or fan controls, as required.

V. Provide small hose and extinguishers

18. Provide small hose, preferably with spray nozzles. Small hose with water spray has proved very effective where ducts have ample access panels. 19. Also have hand extinguishers available. Foam extinguishers are preferable to soda-acid extinguishers for ducts containing oily deposits, paint residues, etc. Dry chemical is effective for fires in light coatings of grease or oily lint. *From the May issue of Factory Mutual Record, a publication of Factory Mutual Fire Insurance Companies, Boston.*

Plugging Soft-Wall Tubing for Bending

THE CUSTOMARY practice of maintenance men when bending tubing is to fill the entire length of the tube with a plugging compound of one kind or another in order to facilitate the bending. After the compound is pressed tightly into the tube each end of the tube is plugged with a metal stopper so that, in effect, the tube becomes a solid piece. There are some dangers attendant upon this practice. If sand is introduced into the tube bore and is in a wet or unduly moist condition, and the pipe is heated before bending, volumes of steam may be generated and the tube may burst.

Resin is another very widely used plugging compound. Here, too, the dangers of a minor explosion are prevalent. One example of such dangers occurred on an air compressor installation where it became necessary to fit oil feed pipes. These pipes required peculiarly shaped bends in order to clear parts of adjacent machinery. The engineer obtained a supply of powdered resin which was inserted into the pipe. The pipe was then placed in a Bunsen jet with the object of heating it to a dull red at the required point. Before the pipe reached this temperature, however, a violent explosion occurred within the bore and the walls of the pipe were split for a distance of about 4 in. A considerable portion of the resin plugging compound was forced out of the split in the wall and some of it burned the engineer's hands.

A safer and more reliable method to be followed when using resin is first to melt it in a separate receptacle until it reaches a fluid consistency. It should then be poured into the tube bore, after one end has been plugged with a metal stopper. When filled, the second plug should be lightly inserted and the pipe laid aside for a short time to permit the resin to set and harden.

When it has cooled and become solid, the pipe should be gently heated at the point where the bend is required. After bending, the plugs at each end should be extracted, and the whole surface of the pipe brought to a sufficiently hot temperature to melt the resin.

Resin, like most other substances, expands upon heating, but if the above procedure is followed undesirable expansion effects are completely neutralized and the whole operation is rendered safe.

A surprising variety of materials and metals are regularly used for such plugging purposes by maintenance men. For example, clay, sand, putty, pitch, solder, tin, babbitt or other metals are habitually employed.

The chief trouble with most of the non-metallic materials is that they contain moisture. Some of these substances are also difficult to remove from the walls of the tube bore after it has been bent to shape.

Paraffin wax will be found the least likely to adhere to the tube after heating and bending, especially if used with copper or brass tubing materials. This is an extremely important point often overlooked when tubes have to be bent in such a manner that the surface of the bore shall remain undamaged and the original smooth polish of the tube has to be retained. If this is not considered, an excellent bend may be obtained, only to find that the plugging compound cannot be completely removed or else it has so marred the surface of the tube as to render it unsuitable for the purpose in view.

The following simple and inexpensive method is often used when employing metallic plugging materials. Before heating the tube, or applying the metal plugging substance, the interior surface of the tube should be coated with the following mixture. A quantity of finely powdered graphite should be mixed with a very light mineral oil, in the proportions of about twenty parts of oil to one of graphite. This should be mixed well together to obtain a very thin paste. The pipe to be treated should then be held vertically and a quantity of the mixture funneled into the bore in such a manner that it is free to run completely through the tube. The pipe should be gently rotated in the hand to insure a uniform deposition of the mixture over the bore surfaces. The pipe should be left standing in a vertical position to allow the mixture to drain off.

The metallic plugging compound should then be melted and poured into the tube in the normal way. Since the surface of the tube bore has become coated with a thin film of the graphite mixture, it will be found that the plugging metal will not adhere and can be easily run out after bending when the tube has been heated up again to the necessary temperature.

If finely dispersed colloidal graphite is obtainable, so much the better, because this is compounded from extremely fine particles of graphite and is already mixed with oil. If such a substance is used it will still be advisable to dilute it with light mineral oil until a free running fluid has been obtained.

To such a treated tube surface, solder, tin, babbitt or lead will not readily adhere. Care has to be taken, however, not to flood the surfaces of the tube bore with such mixtures, otherwise the bending temperature may cause the mineral oil to burn and give off vapors which may prove as undesirable and harmful as is the steam from the non-metallic substances.

With all such plugging operations, it is advisable to provide shallow flats or grooves along the sides of the metal stopping-off plugs inserted at each end of the tube, so as to allow egress for any steam, vapor or air which might be present in the plugging material. *From Dec., 1948 issue of Power Transmission.*

How to Salvage Cracked Water Jackets

A MIDWESTERN plant uses three Ingersoll Rand compressors to supply artificial gas at 15 psi for hardening furnace standby. Maintenance men forgot to drain the water jackets before the Christmas shutdown, and a sudden cold snap opened 14 in. cracks in each jacket. Radial cracks also appeared in two of the cylinder heads.

The same cold wave created an immediate need for the compressors because natural gas supply was cut. There was no question about waiting for replacement parts. The hardening furnaces couldn't operate without compressors, and without the furnaces this section of the plant would have to be shut down. The leaks had to be repaired immediately.

Many thin walled castings can't be repaired because of heat stresses. The plant welding engineer, realizing this, decided that a sealing method of repair with low temperature welding rod would be best.

All paint and dirt were carefully cleaned away, and the surface was ground with a hand grinder. The crack was veed out with a rotary file.

THE little Armstrong No. 800 trap for pressures to 150 psi is the modern version of the Armstrong No. 100 trap which was introduced way back in 1931 as the first small, heavy duty, side-inlet, side-outlet mechanical steam trap ever manufactured for small drips. The most widely used industrial steam trap in the world, it is also one of the most widely imitated, but only the Armstrong No. 800 offers all these advantages:

- Interior mechanism identical in material and workmanship to that in Armstrong traps for 1500 psi, 900° F.
- *Actual tested hot condensate capacity* from 450 to 690 lbs/hr continuous, depending on pressure.
- Free-floating, frictionless leverage system.
- Hardened chrome steel valve and seat.
- 18-8 stainless one piece deep drawn bucket.
- Only 5" x 5⅛" overall; weight 4½ lbs.
- Price only $7.00 list.

The Armstrong No. 800 is *unconditionally guaranteed to give complete satisfaction or your money will be refunded.* Your local Armstrong representative carries these traps in stock and will give you prompt attention if you will call him today. Send for your copy of the 36-page Armstrong Steam Trap Book.

ARMSTRONG MACHINE WORKS, 912 Maple St., Three Rivers, Mich.

ARMSTRONG STEAM TRAPS

***For fuel savings, low maintenance, automatic air removal* SPECIFY ARMSTRONG!**

With a constant motion to keep the flame away from the surface, a torch with excess acetylene was used for heating. A ¼ in. rod of EutecRod 15 was rubbed on the metal until the jacket was hot enough to melt the end and tin the surface. At this stage, Eutector Flux 15 was sprinkled on the area and the same process was continued until tinning was complete.

Next, a ¼ in. ledge was built up about 1½ in. below the crack. Successive layers of weld were built up by using the torch directly on the rod. In this way, a thick layer of alloy was tightly bonded to the surface and flowed into and across the crack to make a perfect seal without once raising the casting above 400 F.

A spiral cutter on a flexible shaft was used to finish off after cooling. Sixty lb. of water pressure was used for a final test, but there wasn't a single leak.

All three compressors were speedily repaired in exactly the same manner without dismantling, and a plant shutdown that would have cost thousands of dollars was averted.—*From Welding Notes, a publication of Eutectic Welding Alloys, Corp., 40 Worth St., New York 13, N. Y.*

Refrigerating System Accidents and How to Avoid Them

Based on a survey of approximately 200 accidents to insured refrigerating systems this analysis shows causes of accidents to the systems, parts which failed and indicated corrective measures. The survey concerned only pressure vessels and piping without regard to machinery and for this reason compressors, circulating pumps, driving motors, engines and other such pieces of equipment are not covered here. The causes of accidents are shown in Table I.

Table I. Causes of accidents arranged by percentages of total

Cause of Accident	% of Total
Corrosion	34.7
Carelessness	21.7
Freezing	9.0
Defective Welding, Brazing	7.9
Defective Materials	7.9
Vibration	5.8
Overpressure	5.8
Poor Maintenance	2.6
Inadequate supports	2.0
Not classified	2.6

In addition to considering the causes of these various accidents, it is interesting to note that the parts that failed initially were, as might be expected, those parts most susceptible to corrosion or to damage from careless acts. Table II shows a breakdown of these parts.

The survey was taken with the expectation that corrective measures might be taken. The results point definitely to a number of things which would materially reduce these failures. They are:

1. Parts of refrigerating systems that are particularly susceptible to corrosion should be periodically examined and preventive measures taken promptly if corrosion is present. These parts include: condensers, vessels containing brine, piping containing brine, piping submerged in brine, and refrigerant piping in cold storage rooms. 2. Any parts of systems which may be damaged through carelessness should be protected by means of suitable guards. 3. All vessels and piping in the system should be of adequate design and, if of fusion welded construction, should meet the requirements of a recognized code. 4. Methods of defrosting should be carefully studied, and any improper or hazardous methods should be discontinued. 5. Any part of a refrigerating system which can be segregated from the system as a whole by means of valves should be protected against overpressure. 6. All protective devices and automatic controls should be checked regularly and kept in good operating condition.

As an example of a more specific program which can be set up, the following is one agreed upon by a large meat packing plant after a careful survey revealed many hazardous conditions to which its refrigeration system was exposed:

1. Start a program of education in safe methods and practices for operating, maintenance and production employes. 2. Institute regular periodic inspections of the entire system by trained employes. 3. Install "Caution" signs at strategic locations as reminders against carelessness. 4. Install suitable guards at all vulnerable locations. 5. Adopt a color code for piping. 6. Relocate and provide permanent identification for stop valves so that they are accessible and easily identified. 7. Install remotely controlled magnetic stop valves on ammonia lines wherever practicable. 8. Install back pressure control valves. 9. Revise the pump-out system to reduce ammonia losses whenever leaks or breaks occur. 10. Provide a portable exhaust system to speed up removal of ammonia fumes from cold rooms and other similar locations. 11. Provide improved ammonia protective equipment for employees. 12. Eliminate all unnecessary piping.—*By T. R. Hardin and A. J. Phillips in The Locomotive, a publication of The Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.*

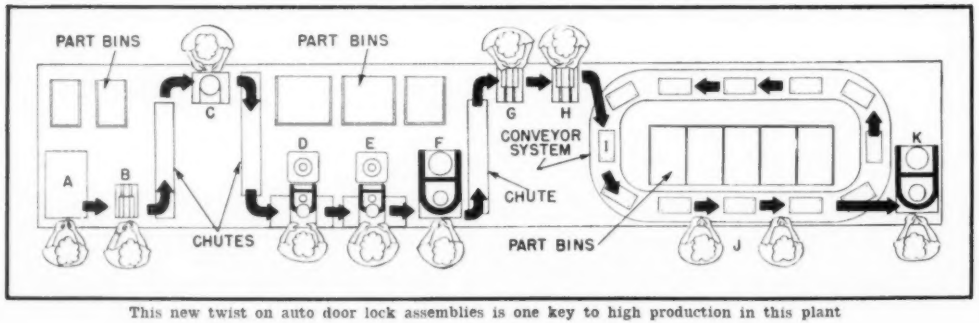
Table II. Parts which failed initially in refrigerating system survey

Part Which Failed	% of Total
Refrig. Coils, Cold Rooms	24.2
Refrig. Coils, Brine Tanks	14.2
Condenser Tubes	13.2
Refrig. Coils, Water Coolers	8.5
High Press. Gas Lines	7.9
High Press. Liquid Lines	5.3
Low Press. Suction Lines	5.3
Refrig. Vessel—Shell	2.1
Refrig. Vessel—Head	1.6
Processing Vessel—Shell	2.6
Processing Vessel—Head	2.2
Gaskets	2.2
Gauge Glasses	1.2
Miscellaneous	9.5

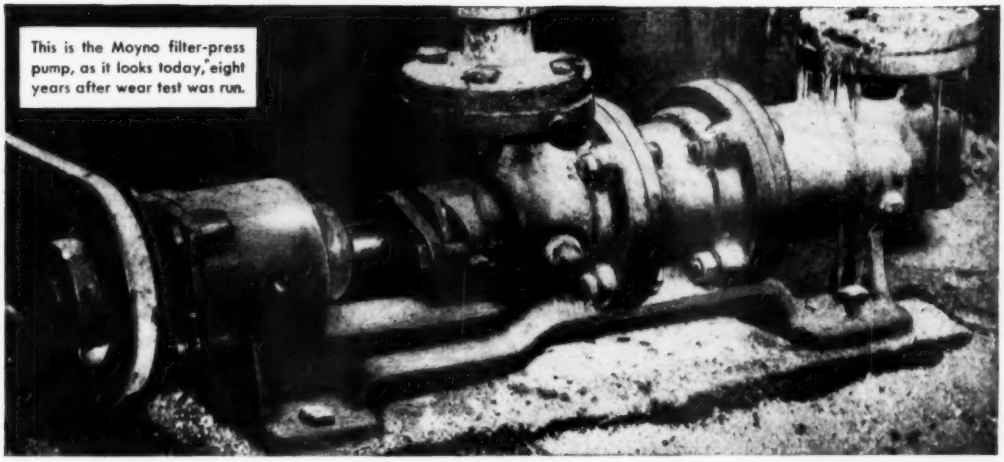
Compact Assembly Layout Speeds Production

Reid Products Division in Cleveland, makers of automobile lock assemblies, has a highly efficient assembly operation for its product. There are three assembly lines, each producing a different type of lock and they have been laid out for maximum economy of floor space and minimum handling of parts.

In place of "move men" previously used to transport parts from station to station, chutes are used to pass the units along the line. As each operator finishes an operation she puts the assembly on the raised end of a chute and lets it slide down to the next operator's fingertips. In this manner, the locks start as individual parts at one end of the line and leave the other end as completed assemblies. *From Volume 2, Number 2, Denison HydrOILic Press, a publication of The Denison Engineering Co., Columbus, Ohio.*



This new twist on auto door lock assemblies is one key to high production in this plant



This is the Moyno filter-press pump, as it looks today, eight years after wear test was run.

MOYNO

LOSES ONLY 1/3 OUNCE IN WEAR TEST

● Here's more proof that R & M Moyno "Progressing-Cavity" pumps can *take* it. A famous lacquer manufacturer carefully weighed the pumping elements of a new Moyno, then pumped 100,000 gallons of lacquer containing an abrasive filter-aid. Re-weigh showed a loss of only 9 grams—*less than ⅓ ounce.* At 500,000 gallons, another check showed *no further change.* Apparently, initial use had merely polished the rotor and stator.

MAINTENANCE PRACTICALLY NIL . . . This Moyno is still going strong after more than eight years' daily use. Not a penny was spent for upkeep in the first two years; the total has averaged *less than one dollar a month*—a sharp contrast to previous repair costs. Like other Moynos, this pump has paid for itself *many times over* in maintenance savings alone.

MOYNOS MAY BE *YOUR* ANSWER, TOO . . . If *you're* faced with pumping problems, investigate these amazing Moyno pumps. "Progressing-cavity" pumping is smooth, non-pulsating, *dependable.* Moynos handle virtually *everything* that will push through a pipe—chemicals and foods, volatiles, abrasive sludges. Bearings are *outside* the pumping compartment; cannot contaminate—or be contaminated. Free Book No. P-22E gives full specifications—write for it, *today.*

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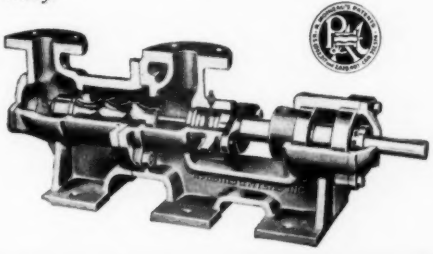
PROGRESSING-CAVITY
PUMP



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Now, Do You Have All the Answers?

. . . no, not quite, for it is almost imperative that you select the *best* power distribution *system* possible.

What is the Best system?

. . . it is the system which gives the greatest value per dollar of investment *and* economically and safely supplies adequate electric service to both the present and future plant loads.

Close Westinghouse co-operation and years of practical experience with all types of industries have led to many outstanding achievements in the development of new distribution systems, methods and equipment. Westinghouse offers such co-operation to all industries in searching out better answers to all phases of distribution and application of power.

Write for the new booklet *"Industrial Plant Distribution Systems"*. Fact-filled pages and colorful diagrams will help you in selecting a system that best meets your requirements. Call your Westinghouse office. Ask for B-4045—or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

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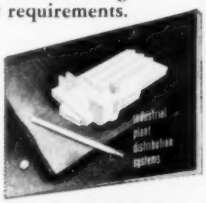

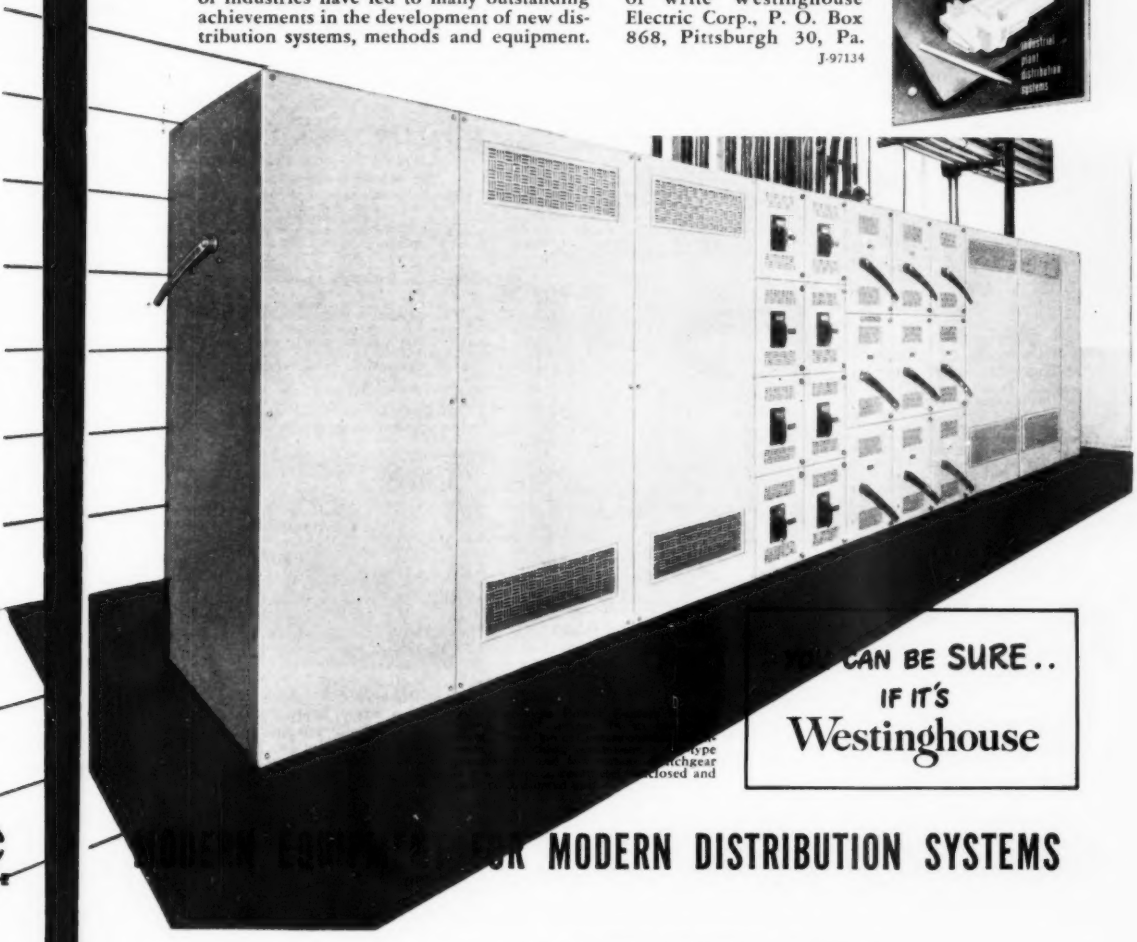

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MODERN DISTRIBUTION SYSTEMS

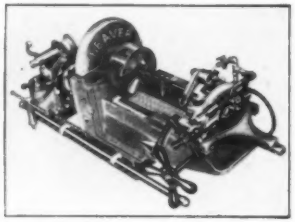
New Products and Methods

WHAT'S NEW? On these pages the Editors summarize the outstanding industrial developments of leading manufacturers who will supply you, free of charge, the bulletins or other information desired. For ease in making requests use the no-obligation, postage-paid card between pages 18-19 and 50-51

1—PIPE AND BOLT MACHINE

Has automatic switch lock and eccentric spool pipe rest

The Beaver Model-A Pipe and Bolt Machine is so constructed that its new automatic switch lock makes it impossible to start the machine unless the chuck wrench is in its holder. This lock is provided to protect workman from injury, and prevent machine from becoming damaged. The new eccentric spool pipe rest—independent from the revolving spindle—is intended to



absorb the "whip" of long lengths of rotating pipe, and prevent excessive wear on spindle bearings. In addition, it is said to eliminate leaking, "flat-sided" threads.

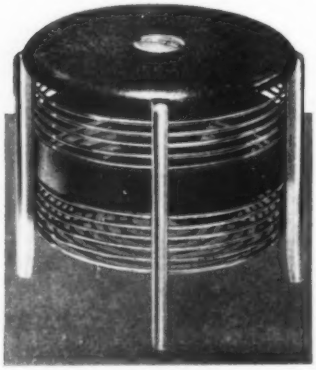
This machine cuts and threads pipe, $\frac{1}{8}$ to 2 in.; with driveshaft and geared tools, its range is increased to $2\frac{1}{2}$ to 12 in. pipe. It cuts off bolts $\frac{1}{4}$ to $\frac{3}{4}$ in. and threads bolts $\frac{1}{4}$ to 2 in. Available in choice of motors, 110, 220, 440 or special voltages; in choice of wheel or knife cutoff, and in 186 different kinds and sizes of dies available from stock. Beaver Pipe Tools, Inc.

2—FLOOR FAN

Has 12-in. blades, is durable and attractively styled

The Breeze-All Floor Fan is built of smooth, mottled mahogany plastic, with chrome plated modernistic die-cast legs and ring-type steel grilles. It is surprisingly sturdy, according to manufacturer, who says that laboratory tests have shown it can withstand weights in excess of 750 lb with only slight damage.

A two-speed motor, mounted on rubber cushions and enclosed in inverted cone-shaped motor housing, is used to turn the four blades smoothly and quietly. The cone is described as a natural baffle, directing cooler floor level air upward and outward to provide a refreshing circulation throughout the room. Requires only 85 w on high speed; is designed to deliver large volumes of high velocity air efficiently and economically. Closely spaced grille rings and underside grille are provided for protection against injury. Said to be easily cleaned and easily kept clean. Robbins & Myers, Inc.



3—DRAIN CLEANER

Is made to clean clogged drains while operator stays clean

Made with a reversible locking ratchet that grips, feeds and releases the cable automatically, the Spartan Rod-O-Matic is designed to clean out clogged drain pipes in sinks, wash basins and tubs, without removing traps or cleanout plugs. Manufacturer says that with the ratchet in forward position, the cable can be fed into the drain, through the cross bar, around the trap and any number of bends to cut the stoppage—completely untouched by the operator's hands.

This unit is recommended for servicing any plant where waste line facilities exist. It is intended to prevent messy floors, dirty clothes and dirty hands. Convenient 5 in. strokes prevent operator from expelling cable faster than needed, it is pointed out, and by reversing the ratchet the full 25 ft of expelled cable may be withdrawn into the drum in less than a minute. The flexible open hook is described as ideal for removing hair, hairpins and lint, common causes of stoppages. The entire unit is made from corrosion resistant materials. Priced at $23.50. Spartan Tool Co.

4—FIRE EXTINGUISHER

CO_2 type, it's lightweight, low priced and easily operated

Called Fyre-Freez, this new carbon dioxide fire extinguisher weighs less than 5 lb, costs less than $10.00 and can be handled by anyone without special training or complicated directions, according to manufacturer. It is intended for combatting flammable liquid and electrical fires. An easily installed wall bracket leaves extinguisher readily accessible for instant action.

Fyre-Freez consists of a long, slim cylinder containing liquid carbon dioxide under pressure and equipped with a plastic nozzle. When the nozzle is turned with one hand a valve opens and releases a rush of harmless carbon dioxide in the form of a fire smothering cloud of dry ice snow. Expanding to 450 times its stored volume, the carbon dioxide acts to dilute oxygen content of the air and smother blaze before it can spread. Walter Kidde & Co.

5—INSECTICIDE SPRAYER

Hand operated, it's designed for efficient insect control

The new West Mistorizer automatically sprays faster, farther and with less effort than previous models, according to manufacturer. It can operate on a-c or d-c, and is said to require no filters, oiling or greasing. A patented airflow system is provided for cooling the motor. Described as leakproof, the unit runs wet or dry. Ball bearings are hermetically sealed. Built for instantaneous and continuous full pressure spraying the Mistorizer is said to be easily handled because of its low center of gravity, which also aids in preventing unit from tipping over. There is also said to be no condensation of steam or water to dilute the insecticide. West Disinfecting Co.

6—PALLET TRUCK

Lightweight and hand operated, for use with expendable pallets

Expendable 4-way corrugated paper pallets having large cylindrical supporting columns can be handled by this truck, which is a revised version of manufacturer's standard model. The new truck is narrow, but has wide space between forks demanded by the large 8 in. dia columns in the center and outer edges of pallets. Each fork is only 6 in. wide, allowing 10 in. opening between forks, and making possible a 22 in. overall width.

Truck has rubber tired front wheels, handle hold and improved foot pump with separate pedal release. A friction brake engages floor when towing handle is held in "down" position. Capacity is 2000 lb. Has lowered height of $3\frac{1}{4}$ in. and elevated height of $7\frac{1}{4}$ in. Truck will also operate in standard double faced wooden pallet. Lyon-Raymond Corp.

7—FLOODLIGHT

Has narrow beam reflector for lighting long, narrow areas

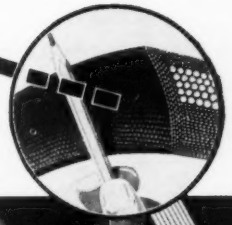
An adaptation of manufacturer's G-E L-69 model, this new floodlight was developed for use wherever the light source must be placed more than 150 ft from the area to be illuminated. It may be ordered from stock. Beam angle of the new floodlight is 20 deg vertical and 24 deg horizontal, with a beam efficiency of 47.5 per cent. Maximum beam candlepower is given as more than 400,000.

Besides the advantage of a higher lighting level in the narrow beam, the new fixture is designed to retain standard features of medium and wide beam L-69s. It has a heat-, weather-, and impact-

This Simple Test
Shows Exactly How

The CONCAVE SIDE...
(U.S. Patent No. 1813698)

Saves You Money!



Pick up *any* V-belt having the ordinary straight sides and *bend* the belt. Three things will happen, right before your eyes.

(1) The top of the belt is under tension and grows *narrower.* (2) The body, under compression, becomes wider. (3) The sides of the belt *bulge out.* (Figures 1 and 1-A, below.)

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove

This bulging of the straight-sided V-belt in its sheave-groove costs you money in *two* ways—(1) The bulge causes uneven sidewall wear—*shorter life!* (2) The bulging side cannot evenly grip the wall of the sheave groove—a loss in *transmission efficiency!*

In figures 2 and 2-A, you see how the precisely engineered *concave* side of the Gates Vulco Rope exactly corrects this bulging.

Gates Vulco Rope with Concave Side.

No Side Bulge. Precise Fit in Sheave-Groove.

Two distinct *savings* result. (1) The Gates Vulco Rope wears evenly—*longer life!* (2) The entire side-wall grips the pulley—carries heavier loads and *sudden load increases* without slippage:—saves *belts* and also *saves power!*

The Mark of SPECIALIZED Research

The Concave Side is *MORE IMPORTANT NOW* Than Ever Before

Because the sides of a V-Belt are what actually drive the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley directly through the belt's sidewalls.

Now that Gates *SPECIALIZED* Research has made available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side is naturally more important in conserving belt life today than ever before.

496

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U.S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

New Products and Methods

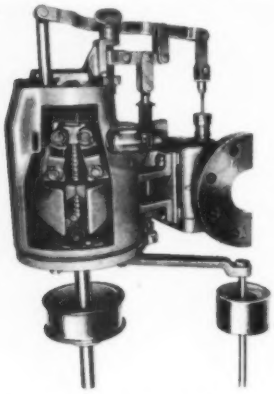
resistant front glass which is spun-sealed to the Alzak processed aluminum reflector to keep out water, dirt and insects.

Vertical and horizontal full-swing scales marked in degrees are provided to simplify positioning and make possible daylight adjustment. Also included is a built-in rifle sight for precision aiming of the beam. Housing for the heavy-duty mogul socket is removable for lamp replacement and maintenance. Once adjusted the beam is not disturbed in normal service, according to manufacturer. Lighting and Rectifier Divs., General Electric Co.

8—THROTTLING GOVERNOR

For steam engines, it controls wide range of speeds

Governor control of steam engine speeds over ranges of 2 to 1, 4 to 1, or 6 to 1, is said to be possible with the new Troy-Enaberg Type EN throttling governor. With it the engine speed can be varied either at the governor or from a remote point, manually or automatically. This new gov-



ernor is described as having totally enclosed construction and self lubricating mechanism. Ball bearings throughout are designed to assure full sensitivity during the long life of the unit.

Further features include automatic stop in event of belt failure, interchangeable parts through a wide range of sizes, and ready adaptability to old or new steam engines of either horizontal or vertical design. Troy Engine & Machine Co.

9—FLOOR POLISH

Is developed to give hardwood floors a non-slip finish

Trafco is described as a solvent-type floor polish that permits hardwood floors to be polished to a high sheen that is non-slip and exceptionally resistant to scuffing and traffic wear. It is said to be the first wood-floor polish to achieve the necessary safety factor with a spirit base, which is harmless to wood. Trafco can take scuffing, yet it stays non-slip and almost refuses to mark up, according to manufacturer, who adds that when a Trafco-polished floor needs a cleaning, special ingredients in the Trafco formula loosen dirt so floors can be cleaned and repolished in one operation.

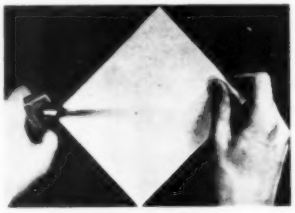
Trafco is intended to present a continuously high coefficient of friction to inhibit slips and falls. Buffing gives it an attractive sheen that is more non-slip than before buffing. Trafco is said to develop fewer "burn" marks, holding them on the surface where they are easily removed.

Manufacturer says that test installations have shown that Trafco is exceptionally durable and easy to apply, and a time saver, since cleaning and polishing operations are combined. It is also recommended as a non-slip polish for linoleum, linotile and similar resilient floors. Listed by Underwriters' Laboratories as a non-slip material. Walter G. Legge Co., Inc.

10—WINDOW SHADE

Is fire repellent; recommended for places of public assembly

When a steady flame is applied this window shade smudges or chars slightly but does not flare up and burn as do many shade cloths. It has been certified flame retardant by the U. S. Testing Laboratories,



awarded the State Fire Seal of Approval by the California Fire Marshal, and recommended by fire authorities.

Made of unfilled cotton cloth sealed with vinyl plastic, the shade, called "Diana Fyrban" retains its fresh new appearance despite rain, sunlight, and frequent scrubbings with soap solutions. Manufactured in standard widths mounted on rollers; may also be ordered in piece lots or in custom-cut sizes on wood or steel rollers. Priced competitively, Diana Fyrban is available in 12 colors and duplex combinations plus stock-figured patterns and special designs. Stewart Hartshorn Co.

11—COMBINATION METER

Is designed to measure both watt-hours and kva thermal demand

A new combination watthour and thermal kva demand meter intended for use by electric utilities having rate structures requiring the measurement of kva demand, this meter, designated as the Type IHE-1A, is essentially the same size as a conventional watthour meter; hence it can be installed without increasing size of the original installation. It is available in the 50-amp, 250-v, 3-wire, single-phase rating.

The watthour meter is essentially the same as manufacturer's I-50 meter, except that the rotating element is of the conventional ball-bearing type. The thermal demand meter unit consists of the thermal unit, a current transformer, a resistance valve, a potential transformer for exciting the heater of the resistance valve, and the driving mechanism, pointers, and scale. Meter and Instrument Divs., General Electric Co.

12—HAND TRUCK

Has telescoping support for adjusting and locking in position

The Tri-Truck, a mechanized, 3-wheel hand truck, is ruggedly built of hard wood and steel for general duty, and incorporates a telescoping support designed to adjust and lock instantly to the correct balance position for any type and weight of load, even with the load on the truck. The Tri-Truck itself balances and supports the load, according to manufacturer,

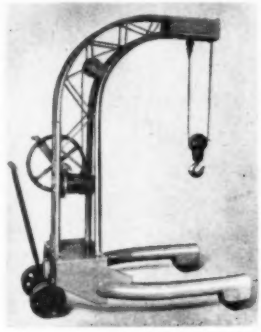
so that inexperienced, older or lighter men can do safe, efficient hand trucking. It is said to provide leverage more than double the trucker's strength for easy loading, to give safe, sure control for unloading and make wheeling almost effortless.

The Tri-Truck is intended to keep load balanced even on difficult surfaces, and even if it hits an obstruction. Once it is loaded, it is set for use as an easel, on the weighing platform, for use in elevators without further loading or unloading. The truck stands 56 in. high, and has 10-in. rubber-tired, roller-bearing wheels and free swiveling ball bearing caster. It can be tilted and locked in positions from fully vertical to fully horizontal. The telescoping support is built of Shelby tubing and ribbed welded steel. Melooz Mfg. Co.

13—PORTABLE FLOOR CRANE

Can be used as hoist, truck or ladder; comes in eight sizes

The Canton Portable Floor Cranes, designed for one-man operation, can be used in lifting awkward loads, simplifying assembly, transporting heavy parts, unloading trucks and storing and tiering. By using one, a man can get to out-of-the-way places where overhead handling sys-



tems can't reach, it is pointed out. They're made of welded steel with high tensile drop forgings for axle hook and fork. Operating mechanism is a self-locking worm designed for automatic holding of load at any point. Eccentric axle locks front wheels when pulling handle is upright; moving handle to pulling position releases wheels. In eight sizes, from 2000 to 6000 lb capacities, and with lifts from 4 ft 6 in. to 11 ft. All except two smallest sizes have two speeds: fast single cable operation for light loads and slower double cable operation for heavy loads. The Hill Acme Co.

14—TROUBLE LIGHT

Is portable, retractable and has finger-tip control

Described as ideal for workshop, garage, factory and workshop, this fully insulated completely caged light can be interchanged with a female plug for use with power tools. It has a radius of 25 or 40 ft from its durable reel rack. A retractable neoprene-jacketed kink-proof cord that reels out easily and automatically locks at the desired length is provided to give all-purpose flexibility. After use a simple tug releases the ratchet and the lamp retracts to the reel, taking it out of the way.

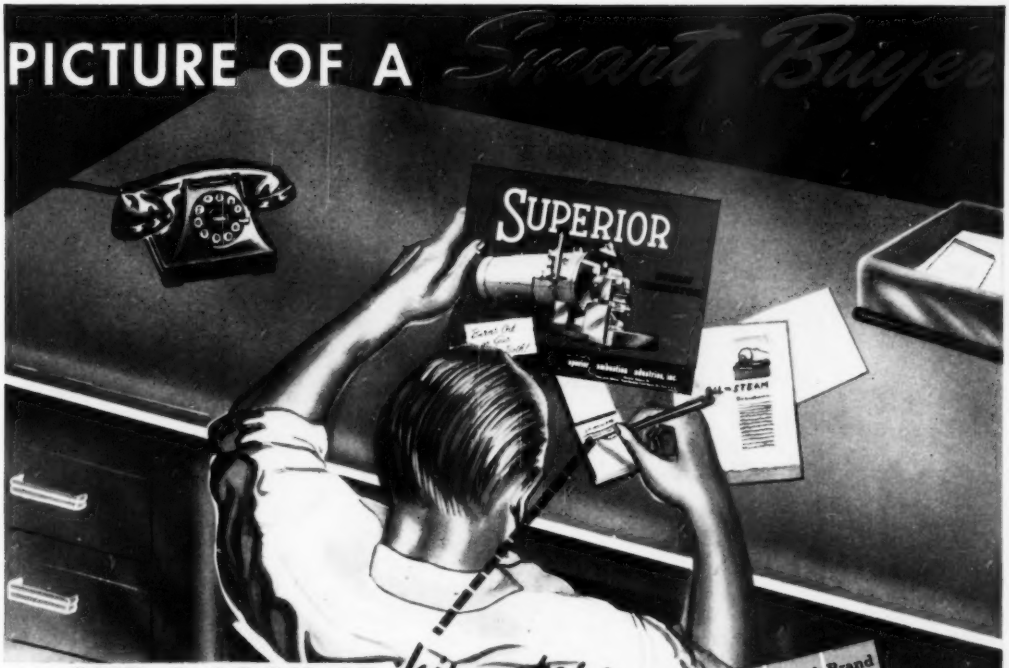
Lamp can be fastened to ceiling or wall for a permanent arrangement, or it can be laid on its side on any flat surface. Has three semi-suction cup rubber feet. M. Black Mfg. Co.

15—ANNUNCIATOR

For heavy duty operation in industrial plants, public utilities

The "ANFA" may be incorporated in new or existing control panels, actuator boards, or instrument panels to indicate occurrence, continuance or termination of any event that is physically perceptible. For example, it may be connected to the normally open contacts of a remote thermostat or thermocouple to indicate when a pre-determined high or low temperature is

PICTURE OF A *Smart Buyer*



. . . AND A LOOK AT *his notes* :

FEATURES OF	Superior Steam Generators	Brand "A"	Brand "B"†	Brand "C"
Fully Automatic	✓		✓	✓
Induced Draft	✓			✓
At least 5 sq. ft. Heating Surface per B.H.P.	✓	•		✓
Shipped Completely Assembled	✓		✓	•
4-Pass Design	✓	✓		✓
Greatest Access to Water Side	✓			
Balanced Gas Travel	✓			✓
Rotary Burner for No. 5 or No. 6 oil	•	✓	•	✓
Automatic Oil Viscosity Control	✓			

* Limited to some types and sizes
† Three other brands showed results identical to those shown in this column

CAN

This smart buyer is doing what *you yourself* would do before buying any steam generating equipment . . . checking requirements against performance . . . claims against the limitations of design. We like to see a man do that. It means — every time — that Superior's functional and efficient *package* steam plant stands out as the best dollar-for-dollar investment in either original or additional steam generating equipment.

And that is easily explained. Point-by-point comparison leads the really smart shopper to the steam generator that has been designed and built *around* his steam generating requirements. Make the comparison for yourself . . . from his notes. Superior Steam Generators are available in 17 sizes from 20 to 500 b.h.p. at pressures from 15 to 200 p.s.i. For specific details write for Catalog 105.

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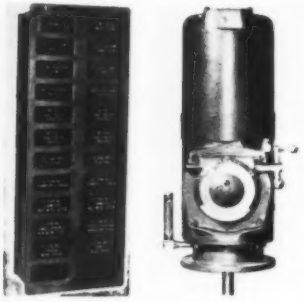
Factory Emmaus, Pa.
Executive Offices Times Tower, Times Square, New York 18, N. Y.

New Products and Methods

reached. It may also be utilized to indicate opening or closing of doors, valves or gates; to signal interruption of a beam of light between a lamp and the cell, or actuation of the cell in the presence of light; to indicate when a liquid level rises above or drops below a pre-determined point; to signal starting, stopping or continuance of the flow of liquid. The Autocall Co.



16—VARIABLE DRIVE

For all speeds up to 1100 rpm, built for vertical mounting

The new Type F Graham variable speed transmission is designed for vertical flange mounting. It has standard NEMA flange mounting dimensions and can be furnished with special shaft extension where required. Spaced bearings on the output shaft with two tandem mounted oil seals are provided to insure against oil leakage.

The micrometer control, shown, is designed for extremely accurate speed settings. The transmission is intended to closely maintain its set speed even with change in load, and is recommended for metering and proportioning or for mixing applications where change in viscosity occurs. Drive is available without motor or with built-in three-phase or capacitor start-induction run, 1800 or 3600 rpm motor. Graham Transmissions, Inc.

17—CODE CALL UNIT

Utilizes call numbers to signal persons anywhere in the plant

The principal function of this system is that when a person fails to answer the telephone, the operator can locate him by pressing a button which broadcasts that person's code call number three times on signalling devices throughout the premises. The telephone call is promptly completed through the nearest extension. Dial in position 1 is for standard 3-round call;

when turned to position 2, it permits continuous repetition call.

Sending station, illustrated, is furnished complete for 20 calls. This can be increased to 40 calls without change in installation. A numerical code is assigned to key personnel of an organization, and a call is made by sounding that code on bells, chimes, horns or other signalling devices at selected locations. This arrangement reduces time required for completion of calls by permitting operator to quickly locate person wanted. System can be equipped for "night telephone connection" or "watchman's call." Signal Engineering & Mfg. Co.

18—LIQUID LEVEL CONTROL

Is designed especially for heavy duty industrial service

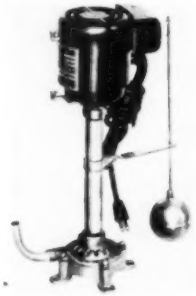
The new Type H Liquid Level Control units feature standard or explosion-proof cover, forged steel body, stainless steel float, and non-corrosive switch unit. Models are available for internal pressure ranges from vacuum to 600 psi and temperatures to 700 F. They are suitable for use with wide variety of liquids of 0.55 specific gravity and upwards. (Units for higher pressure control and for fluids below 0.55 specific gravity are made to order, and special materials can be supplied for use with chemicals or corrosive materials.)

This unit is designed for control circuits, level indicating lights and alarms. It is not recommended for direct use with motors. The standard H control is furnished with $1^1/_4$ in. male connections. Jo-Bell Products, Inc.

19—SMALL IMMERSION PUMP

For circulating, agitating, emptying, filling, transferring

Here's a miniature vertical electric pump developed for handling oily, acid or alkaline liquids. Its height is $14^1/_8$ in., weight $9^3/_4$ lb. The pump is powered by a 1/30 hp motor.



Features claimed for it are its bearingless pump, only one moving assembly; self-cooling continuous duty motor; double inlets designed to prevent clogging; silent operation; stainless steel one-piece shaft, and open-impeller design for handling a reasonable amount of solid matter easily. Samuel S. Gelber Co.

20—ELECTRICAL TAPE

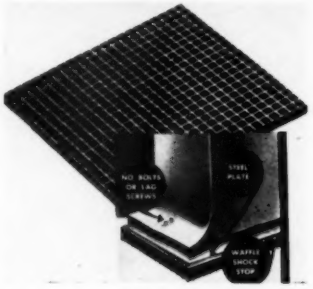
An extra thin tape, it offers bulk-free insulation advantages

Bauer & Black No. 163 Electrical Adhesive Tape is described as exceeding ASTM friction tape standards in several ways: it has a higher dielectric strength, 2000 v; is a better moisture barrier; is thinner, yet has equal tensile strength; has a higher tack; is cleaner and unwinds easier. It is also said to be non-fraying and to stick firmly to any clean, dry surface. It is said to cost no more than most friction tape. Industrial Adhesive Tape Dept., Bauer & Black.

21—VIBRATION DAMPENERS

Are made of rubber and have a semi-pneumatic action

Vibrations set up by most types of motorized equipment can be isolated by placing Shock Stops between base or feet of the equipment and the floor or foundation. Floors, walls and ceiling are guarded from damage, noise is reduced and



production increased, it is claimed. Shock Stops are said to be equally effective in protecting balances, electronic devices and similar delicate equipment from outside vibrations.

Available in large 18 by 18 in. sheets that may be cut to required size and in circles of $3^1/_4$ and $2^1/_4$ in. dia. The waffle-like grid of the Shock Stop design when laid on a smooth surface tends to trap air, it is said. Vibrations of unwanted amplitudes are diverted by this air through supporting ribs. Manufacturer says tests show that where the disturbing frequency runs between 1000 and 3000 cycles per minute a reduction of 75 to 90 per cent may be obtained. The Connecticut Hard Rubber Co.

22—REDUCING VALVE

For handling working pressures up to 6000 psi without shock

The Type E High Pressure Reducing Valve is recommended for reducing the pressure of water, oil, and compressed air —in a single stage to 250 psi or to within 20 per cent of initial pressure. (For lower reduced pressures the reduction should be made in two stages, the first stage through this Type E and the second stage through a valve for handling working pressures up to 300 psi.)

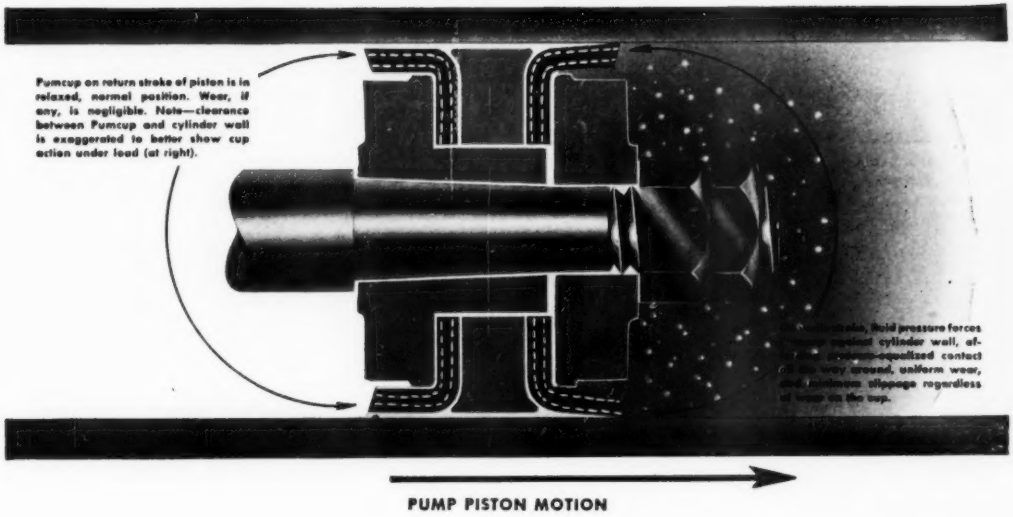
The body of the Type E valve is forged steel. Internal metal parts are hard chromium plated stainless steel. The one piece seat stem and removable seat are easily reground and replaced, it is said, and plastic cup washers are specially made for high pressure service. The pressure on the seat is balanced by a piston above, so that variations in initial pressure have little effect on reduced pressure. A formed packing of special material has been adopted which is claimed to be immune to water, oil and other fluids commonly used in hydraulic machinery. The Atlas Valve Co.

23—OPERATING VALVE

Is self-sealing ball type for use on air or water lines

The Type BA-1 valve is fitted with a quick-opening lever which may be adjusted to any horizontal position. The ball valve is designed to close tight with inlet pressure and not collect dirt or other foreign matter. Stem is sealed by an O-ring not accessible to tampering or adjustment. It is self-packed by operating pressure when valve is open, permitting flow. Valve is suitable for use with air, or fluids of a non-corrosive nature up to 200 psi pressure and temperatures up to 150 F air and 180 F water where fast, positive action and tight closing are desired.

Valve has cast semi-steel body, integral rubber seat insert, screwed connections. $^1/_2$ in. size can be bushed to $^1/_4$ or $^3/_8$ in. Can be adapted as an operating valve for air whistles, for control of pneumatic cylinders on lifts, hoists, presses, for cleaning air blasts on forging hammers, as a small valve for general machine service and for control of flushing liquids, and as a quick operating shower valve for emergency showers in chemical plants. Leslie Co.


Pumcup on return stroke of piston is in relaxed, normal position. Wear, if any, is negligible. Note—clearance between Pumcup and cylinder wall is exaggerated to better show cup action under load (at right).
PUMP PISTON MOTION

NEW RETIREMENT PLAN . . .

for piston packing

WHAT is the "retirement age" of the piston packing in your reciprocating pumps, or in your air or hydraulic controls? A day? A week? A month?

Think what you could save in maintenance expense, in costly shutdowns, with a packing that does a perfect job 5, 10, or even 100 times as long. That's exactly what Darcova Pumcups are doing in thousands of installations where they have replaced leather crimps, ring packing, metal or plastic rings, or other ordinary packing.

How? First, the drawing above shows how the cup principle, scientifically applied the Darcova way, minimizes friction, equalizes and retards wear. Second, Pumcups are made of a special, Darcova-developed composition, exceptionally wear-resistant and immune to tough pressure and temperature conditions. Third, Pumcups are precision-built in many different textures, each absolutely uniform. Fourth, despite wear, high volumetric efficiency is retained for the life of the packing.

So, if you're not using Darcova Pumcups, you're in line for a new piston packing "retirement plan"—one that will save you plenty of time, trouble and expense. For a free bulletin containing complete information, write, or use the coupon below.

Darcova Pumcups are made in standard sizes from ½ to 42 inches in diameter, are easily installed in any reciprocating pump or air or hydraulic mechanism to replace ordinary packing. They handle virtually any fluid under a wide range of pressure and temperature conditions.

DARCOVA
THE ORIGINAL COMPOSITION CUP

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Darling Valve & Mfg. Co., Williamsport 14, Pa.
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New Products and Methods

24—PILER—FLATTENER

Saves storage space by making bags less bulky

Designed to flatten and elevate bags in one operation, this Piler and Flattener comes in sizes from 12 to 20 ft. The unit is portable and is available with power-driven mechanism for self propulsion. Newly-packed bags handled by the piler-

flattener are made smooth, less bulky and may be piled more easily in less warehouse space, it is said. As bag is conveyed through the unit, the kneading and pressing action of the top hugger boom eliminates air from the bag to produce a smooth, well shaped, easily handled bag. The Flexoveyor Mfg. Co.

25—STEEL SHELVING UNITS

Adjustable open type, they come in seven colors, many sizes

These all steel shelving units have baked enamel finish and come in office gray, office green, cream, blue, yellow, red and brown, in plain or Hammerloid finish. Available in eight standard shelf sizes from an 8 by 24 in. shelf to a 24 by 36 in. size, and in lengths from 3 ft $1\frac{1}{8}$ in. to 10 ft $1\frac{1}{2}$ in.

With the 1 by 1 by $\frac{1}{8}$ in. angle iron corners punched every $1\frac{1}{2}$ in., this unit is readily adaptable to any shelf opening and, with dividers and an outer steel shell, may be converted to a closed type shelving unit for use as parts bin or for storage compartments. Designed to carry a load of 100 to 150 lb, depending on size of shelf, the units also are available in special sizes and strengths. Hilco Mfg. Co.

26—BEARING TOOL

Removes and replaces sleeve bearings in one operation

Worn sleeve bearings can now be removed from motor endplates, and new bearings inserted in one operation with this tool, according to manufacturer. It consists of a steel rod, finished to accommodate precision bored bearings on one end, and unbored bearings (for undersize shafts) on the other. A central shoulder separates the two ends.

The new bearing is slipped on the rod,

its unchamfered end against the shoulder of the tool. A spacer, furnished with the tool, is slipped on with its unchamfered end against the new bearing. The end of the tool is then inserted in the old bearing, from the inner side of the endplate, with the new bearing positioned so its oil wick hole lines up with the hole in the old bearing. A press or a rawhide mallet is used to drive the tool until its shoulder seats against the endplate. The spacer forces out the old bearing, and the new bearing, as it is pushed into position, forces out the spacer.

The old bearing is intended to act as a pilot, assuring correct alignment of the new bearing. No reaming is necessary. Tool is available in four sizes, for motors with finished bearing sizes of 0.655, 0.751, 0.812 and 1.062 in. Wagner Electric Corp.

27—125-LB S P VALVES

Feature improved design for greater strength, longer service

Available in globe, angle and check types, the globe and angle valves have a malleable iron handwheel, described as non-heating; identifying nameplate; hexagon head gland designed to eliminate "prying" when repacking; machined repacking seats; solid bronze discs which are renewable on $\frac{3}{4}$ in. and larger sizes. The deep stuffing box is intended to allow tight joint even when fully packed. Large clearance at end of pipe threads permits tight joint without danger of pipe jamming diaphragm, it is said. Stems are a silicon bronze alloy claimed to be extremely long lasting.

Lift and swing check valves have similar features. In the lift check, guide lugs on the disc and guide sleeve are provided to assure positive seating. Swing check has two renewable side plugs which serve as bearings for the disc carrier pin and permit removal of pin from either side, advantageous when valve is installed close to wall. The Lunkenheimer Co.

28—PAVING BREAKER

Is lightweight, sturdy, and built for long service

Intended for fast demolition work and for use wherever footing is treacherous is this new paving breaker. Known as the B37, it weighs but 38 lb and has a renewable check liner, easily replaced at low cost. The hammer is of the block type pistol type, reversible for longer life. The use of a tappet is designed to minimize wear on the hammer striking face, and the tappet operates in a renewable bushing.

Said to be an exclusive feature of the B37 is the throttle valve lock, which works like the "safety" on a gun, thus enabling workmen to avoid accidents. The B37, too, is also said to minimize operator fatigue by having a fast cutting action without violent recoil. An efficient, low-lift plate valve is intended to assure low air consumption, while the long piston stroke provides a hard-hitting blow. Manufacturer states that the exhaust will not freeze. Gardner-Denver Co.

29—SEQUENCE CONTROL

Is intended for measurement and control of process variables

The Multi-Switch Capacitrol has been added to manufacturer's line of controllers. Incorporating a "distant view scale," front accessibility, plug-in chassis design and voltage selector plug, the instrument is available with a maximum of four switches (single-pole, double-throw) to provide a selection of six different switching sequences.

A high resistance, fully compensated, direct reading meter movement with Alnico V magnet is used for applications which fall in the pyrometric range. Models using resistance thermometer measuring systems are available for low temperature operation. Wheelco Instruments Co.

30—SPEED REDUCER

Is lightweight, requires little headroom, and uses stock parts

This vertical speed reducer is said to weigh only $\frac{1}{2}$ to 1/3 as much as comparable units. Because little headroom is needed, it is adaptable to many industrial operations. It will provide any driven speed below 154 rpm from standard stock parts and is said to offer a vertical speed reduction drive at very low cost.

Designed for easy installation, the unit is built for mounting on the shaft of the driven machine. The drive can be selected and installed from simple catalog information, according to manufacturer. Other advantages claimed for it are quick speed changes (pulleys or sheaves of different diameters can be substituted in primary belt drive or standard adjustable-diameter sheaves used); easy change of location (interchangeable bushings permit application to shafts of various sizes), and quiet operation. The American Pulley Co.

31—HOSE CONNECTION

For use on paint spray hose, is easily, quickly detachable

The Binks quick-detachable connection is designed to shut off fluids under pressure when the hose connection is broken and to instantly restore the flow when the connection is re-established. It will not squirt when connection is made or broken, won't leak, stick or jam, according to manufacturer.

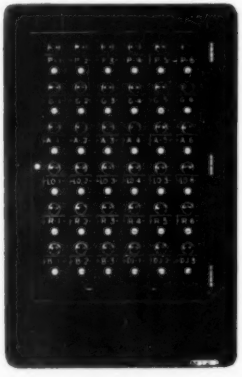
Using a bayonet-type joint, this connection can be made or broken almost instantly, with a slight turn of the wrist,

it is said. It is a companion product to Binks quick-detachable air connection, which applies a similar principle to air supple lines. Both are made in standard air and material hose sizes, with standard threads to fit manufacturer's fittings, spray guns and spray painting equipment. Binks Mfg. Co.

32—ANNUNCIATOR

Uses both visual and audible alarms to signal warnings

This supervisory annunciator is recommended for signalling overheated bearings, low fuel level, too high or low pressures, too high cooling temperatures and the end of processing cycles. When trouble occurs the Auth Bull's-Eye Lamp Type Annuncia-



tor receives an electrical impulse from a normally open or normally closed, momentary contactor, such as a thermostat or float switch. This impulse causes a maintaining contact in the annunciator circuit which operates a visible signal indicating on the board where trouble is developing

THE GOOD RIGHT HAND OF INDUSTRY

Meet the Only

NEW Air Compressor Line *Since the War*

It's the Worthington Balanced Angle—the really modern-looking vertical air compressor that is as up-to-date *inside* as out!

See how this machine has been redesigned from the bottom up to give you everything we know you want in an air compressor—

You Get Smoother Performance because the V-type cylinder arrangement gives better running balance and faster cooling.

You Get Higher Efficiency because the isolated cylinders have 35% more heat radiating surface than in-line type; the aluminum heads release heat faster than cast-iron; and the high-speed fan throws 6 times as much air across the cylinders.

You Get Lower Maintenance because the valves are exclusive Worthington Feather* Valves; lubrication is controlled; bearings are famous Timken roller bearings, including oversize main bearings.

You Get Longer Life because the pistons in each stage, though different in size, *weigh alike*, reducing vibration; crankshaft is drop-forged steel with integral counterweights; bearing pressures and piston speed are low.

Your Worthington Air Compressor Distributor has a complete line of single and two-stage models, bare or tank-mounted, ½ to 15 hp.

PC.9.6

*Reg. U. S. Pat. Off.

WORTHINGTON

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PUMP AND COMPRESSOR MERCHANDISING DIVISION
HARRISON, NEW JERSEY

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Name.....

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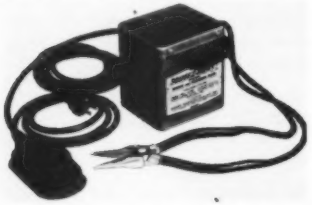
New Products and Methods

and, simultaneously, sounding an alarm. This annunciator is said to be especially valuable for public utilities, refineries and large industrial plants, since it is intended to permit centralized control of trouble spots and prevent breakdowns. Auth Electric Co.

33—ELECTRIC PLIERS

Use current-resistance principle for faster soldering

The Durst Electric Soldering Pliers are said to provide freedom from "cold joints" and reduce soldering labor. Heat is reported to be instantaneous. Wires or parts



to be soldered are held by pliers, the foot switch is depressed for an instant, heating wires or parts enough to melt the solder. The current resistance principle is used to heat work only at point of contact.

Pliers remain cool at all times, it is pointed out, and resultant joint requires less solder. This "heat in the work" process is designed to make a solder-weld at a localized point without heating entire terminal or scorching, burning or shrinking the insulation. Pliers are said to consume little current. Their effectiveness ranges from 14 to 30 gage copper wire. They can also be used to silver braze small metal parts. Durst Mfg. Co.

34—STROBOSCOPE

For observations of machinery running at lower speeds

The Strobolume is a high-intensity, short-flash stroboscope for observations of textile looms, printing presses, fuel injection systems and heavy machinery. With it, even a single, isolated flash is said to produce a definite stationary image of the moving object on the retina of the eye.

It is designed to be flashed from an external contactor, and is useful where motion to be examined is related to angular position of a shaft, such as a crankshaft, camshaft, or countershaft, on one end of which a contactor is held or clamped. A push-button is provided for tripping single flashes. The lamp can also be flashed from a special, slow-speed Strobolac.

It will operate continuously at speeds up to about 45 flashes per min. Operation for increasingly shorter periods is possible up to 1200 per min. Whenever maximum safe operating time is reached a circuit breaker opens to turn off power supply.

Compact and portable, instrument is housed in metal case with handle. Overall dimensions are 13 by $7\frac{1}{2}$ in.; net weight is $18\frac{1}{2}$ lb. Lamp assembly is connected to power supply through a 10-ft cable and is removable. General Radio Co.

35—CIRCUIT BREAKER

Is also available as circuit interrupter of high capacity

A new, compact 50 amp—600 v and 100 amp—250 v circuit breaker, the ML-1, includes all construction features of manufacturer's other breakers, but is 50 per cent smaller than previous unit for this capacity. It has a thermal-magnetic (coilless) tripping mechanism, in which a thermal element holds harmless momentary overloads, but trips before wire insulation overheats on continuous overloads. A magnetic element trips quickly on shorts to localize damage. The company points out that repeat circuit protection is provided with maximum simplicity and downtime is minimized, for nothing burns out and there is nothing to replace.

The ML-1 breaker is available in special enclosures to meet every service application, including dust-resisting, rain-tight, weatherproof and dust-tight, and explosion-resisting styles. Ampere range is 15 to 50 amp at 600 v a-c, or 250 v d-c; or 70 to 100 amp at 250 v a-c or 125 /250 v d-c. Square D Co.

36—BONNET GATE VALVE

Of stainless steel, is small and corrosion resistant

This new corrosion resistant valve is described as a small, stainless unit, simple in design and reliable in performance. Its construction features include union bonnet design, ball and socket point contact discs which adjust themselves in any position, and a minimum of six turns of packing to assure effective sealing. Available in various stainless alloys, in sizes $\frac{1}{2}$, $\frac{3}{4}$ and 1 in., this valve is suited for fixed plant installations and use on fabricated equipment. The Cooper Alloy Foundry Co.

37—ANTI-RUST PAINT

A heavy-duty aluminum paint, it is bright and long lasting

Rustrem "Super" Aluminum utilizes a newly developed aluminum paste with an aluminum content claimed to be exceptionally high. Manufacturer guarantees it

will "leaf" on all surfaces and not turn brown under adverse weather conditions. It can be applied right over rust without wire brushing or scraping, and is said to seal the surface to prevent further rust action. Suitable for both interior and exterior use, it is furnished in proper consistency for either brush or spray application. Speco, Inc.

38—CONVEYOR CARRIER

Is lightweight, but built for continuous, heavy-duty service

Features claimed for the SealMaster Ball Bearing Conveyor Carriers are strength, lightweight, low power requirement, minimum maintenance, low pressure lubrication and interchangeable parts. They have ball bearing belt idlers with live shaft rollers for economical belt conveyor operation. Rigid one-piece welded steel frames are designed to tilt in the direction of the belt travel and keep belt centered without guide rollers. An inverted angle base and end brackets are provided to shed material and keep rollers free.

Removable rollers and bearing housing are easily replaced or interchanged without tools. Six permanently sealed, self-aligned ball bearing units independent of their housings, are arranged for one-shot, low pressure lubrication from either side of carrier. All welded construction. Stephens-Adamson Mfg. Co.

39—COOLING TOWER

Of medium to large capacity; in wood or steel construction

The Verflow is said to be easily erected, require little maintenance time and contain features usually found only in heavy-duty industrial towers. Among features claimed for it are "lifetime" nailless filling, easily removed and re-installed; balanced spray system with low pressure nozzles; access port; totally enclosed motor; enclosed bearing housing with grease-packed bearings; air-foil section cast aluminum alloy fans, multiple-celled units if desired; hinged louver frames and removable louvers. Wood towers have heavy double-sheathed casing; metal towers are finished in corrosion-resistant paint. The Marley Co., Inc.

40—FLEXIBLE JAW PLIERS

Require only light pressure to hold parts securely

According to manufacturer, the jaw members of these lightweight rubber-handled pliers can be instantly shifted to various angles within a 110 deg radius and be used successfully in all positions with plenty of power in the grip. They are recommended for holding assembly parts, positioning and holding nails, screws, bolts and nuts, pulling or placing cotter pins, and for assembly jobs in inaccessible places. May be used at point of operations and around presses; and are also described as practical for holding and gripping glassware, porcelain, plastic or pottery by placing a small piece of rubber on the jaws to prevent scratching or a hard bite.

Jaws and handles are of heat-treated chrome molybdenum steel, and are serrated to hold securely. Steel bolts have elastic stop nuts. Length $10\frac{3}{4}$ in., weight $8\frac{1}{2}$ oz. Priced at $3.25. Industrial Products Co.

41—PNEUMATIC VIBRATORS

For jobs requiring constant or intermittent vibration

Series "SA" pneumatically operated vibrators are said to feature low air consumption, minimum number of parts, instant starting with full power. They are recommended for removing match-plate patterns from sand molds, assuring steady flow from hoppers feeding parts for assembly, settling the 'mix' in concrete product and block making machines, vibrating tables used in product packaging, fatigue testing complete assemblies, and moving granular materials through chutes and tubes.

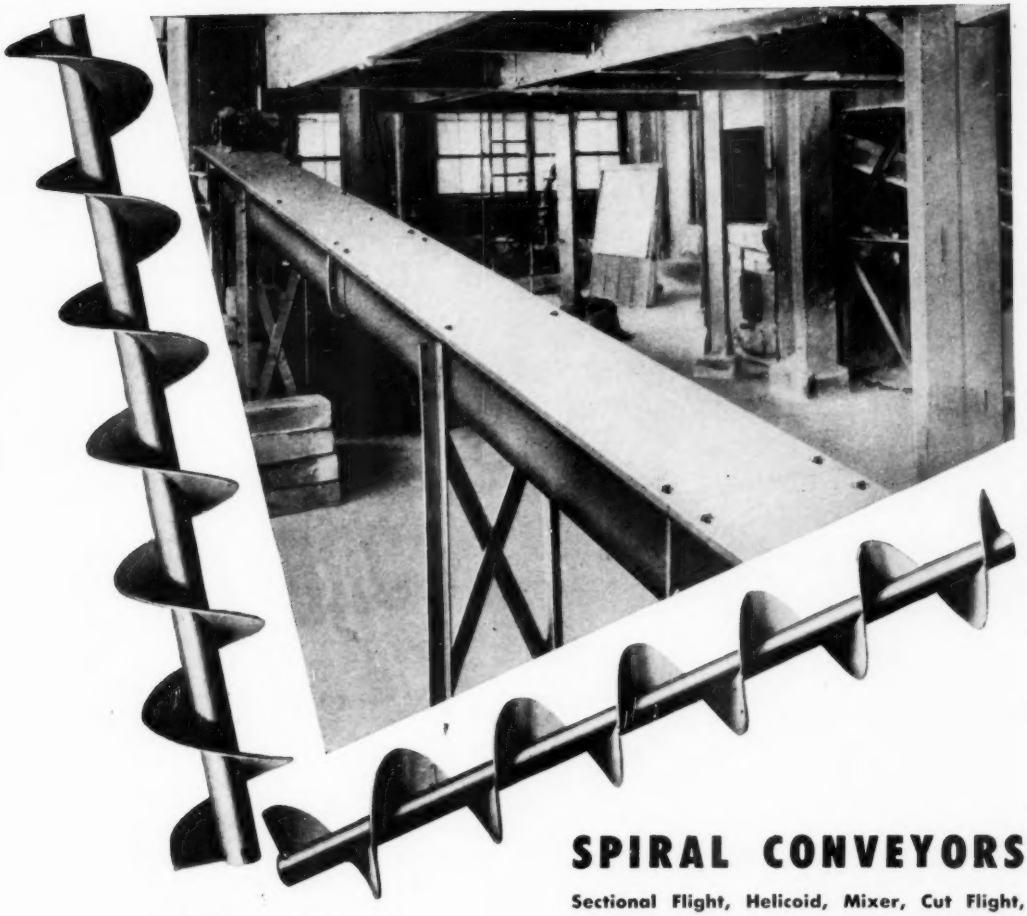
Seven sizes are available with five different mounting arrangements, ranging in overall dimensions from $5\frac{3}{8}$ by $\frac{7}{8}$ by $1\frac{1}{2}$ in. to 8 by $1\frac{3}{4}$ by $2\frac{1}{4}$ in. Air consumption ranges from 5 to $8\frac{1}{2}$ cfm on 80 psi line pressure. At this same line pressure, speeds of operation range from 5100 to 1950 vibrations per minute on the largest size. Piston diameters are $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1 and $1\frac{1}{4}$ in. The Cleveland Vibrator Co.

42—BOILER DE-SCALER

Is developed to purify hard water through electrolytic action

The Butler De-Scaler is intended to lengthen the life of a boiler tube and cut maintenance cost. The unit consists of a silver-plated copper case within which is a special cartridge. Electrolytic current is generated within the unit, with the container acting as a cathode and the cartridge as an anode. Water circulating through the De-Scaler furnishes the carrier. The action thus created within the unit tends to overcome lesser electrolytic effects of other metals in the boiler.

The cartridge is said to have a greater affinity for free oxygen than other metals in the boiler and bears the brunt of corrosive attack. The De-Scaler thus operates to produce water no longer hard, which prevents formation of new scale and causes scale already hardened to soften and fall to the bottom of the boiler. For use in both high and low pressure boilers. Butler Engineering Co.



SPIRAL CONVEYORS

Sectional Flight, Helicoid, Mixer, Cut Flight, Ribbon and Cast Iron — six types manufactured by modern methods with equipment especially designed for the purpose, insuring uniform strength and true alignment. Handle many kinds of material — capacities vary with size of conveyor. No return strand — saves time and cost. Jeffrey spiral conveyors are interchangeable with other standard makes — are built to industrial standards. Write for data.

They meet Practically Any Requirement and Operating Condition

THE JEFFREY MANUFACTURING COMPANY

Established 1877

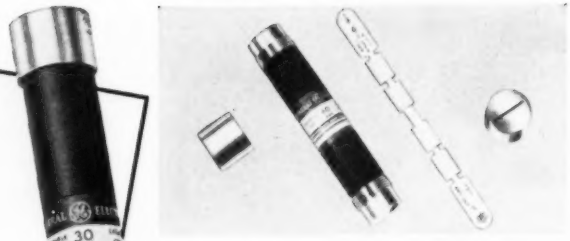
905 North Fourth St., Columbus 16, Ohio

Baltimore 2, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Harlan, Houston 5, Huntington 19, Jacksonville 2, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1, Scranton 3

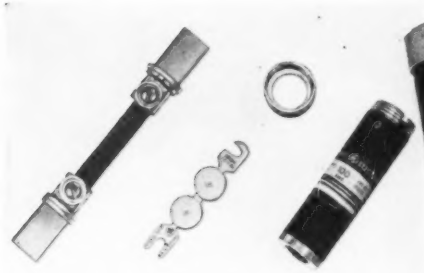
Complete Line of Material Handling, Processing and Mining Equipment

NOW TIME DELAY

that you can really depend on



New G-E ferrule-type fuse, now available in all commonly used sizes, is all new, all the way through. Only three parts to handle. Hinged door eliminates loose washers and small parts. You can renew them fast—you can count on them to do a dependable job.



New G-E knife-blade-type fuse, also available from your distributor in all commonly used sizes, is designed for easy renewal. Just loosen the screws—they can't fall out—and washers guide link into place. Washers are cup-shaped to protect the screw heads from splashed zinc and to prevent screwdriver from slipping.

ORDER G-E RENEWABLE FUSES

from the new wide range of sizes

Get the satisfaction of fuses you know you can depend on. There's no need to accept substitutes—order these all-new time-delay fuses from your distributor today.

Designed for extra reliability on the job, links used in these new fuses are the product of extensive General Electric research on normal time-delay requirements. Oversized lugs absorb the heat of momentary overloads. Sensitive connecting links blow fast when loads exceed normal peak. For fuses you can really depend on, stock up now on the new General Electric time-delay renewable fuses.

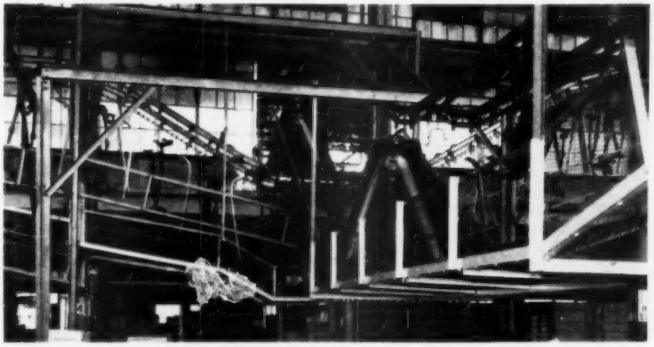
For more information on the new G-E fuse line, write to Section D34-783, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in

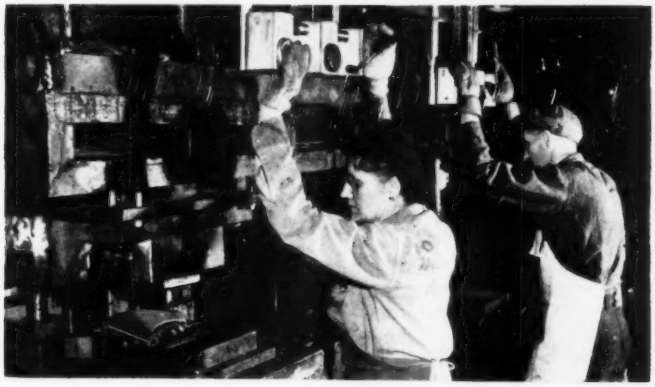
GENERAL ELECTRIC

Safety Crimes—Not Here!

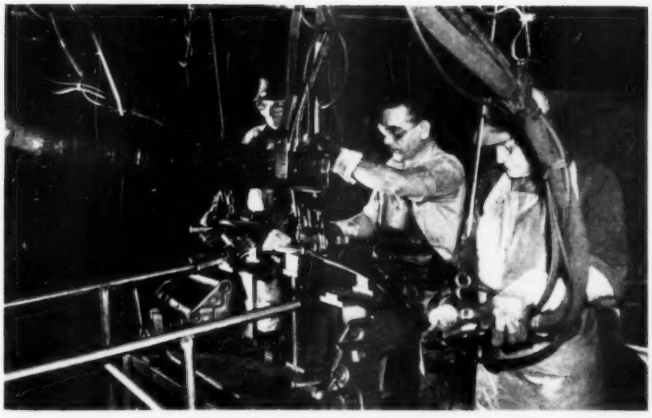
Safety is a never-ending job. Results of a good safety program usually are intangible unless compared to records of performance prior to its inauguration. Lack of an effective program is felt through reduced earnings of employes and company, ascending insurance rates, tumbling efficiency of workers. Safety of employees and safety of equipment are inextricably tied together. Photos: Pontiac Motor plant



Falling objects can extract a heavy toll of industrial workers. Pontiac Division of GMC is taking no chances. Protective screening is installed under all overhead conveyors which carry heavy parts. In order to keep Pontiac's good safety record clean, officials hold once-a-month meetings to review the safety performance of the plant and to compare their record with records of other divisions of General Motors. They discuss prevailing policies and make provision for correcting and formulating policies for safety, guarding equipment, education



Full control of these punch presses by their operators is assured by four-control switch buttons. Both hands must be placed on the control and be holding buttons through full stroke of press, otherwise the press will stop. Superintendents at Pontiac meet with their foremen at least once a month to discuss major safety problems and explain general safety policies as approved by top management. The foremen are required to talk with at least two of their men each day regarding these established policies



The operation of welding grille brackets requires a number of safety measures for all the workmen. Shown here are some of the principles employed: ventilation, safety goggles, gloves and aprons. All wires must be tied and clear of workmen's reach and they must be properly insulated. Foremen, at Pontiac, accept the responsibility for supervision of safety in each of their departments and they are the ones who write orders for such safety equipment as machine guards and appliances

PLANT HEATING CONTROLS SAVE—

60,000 Man-Hours, $30,000 in Fuel Annually

At The Glenn L. Martin Co. plant in Baltimore, Plant Engineering has worked out operational refinements of the entire heating system . . . Problem primarily embraced simultaneous control of 35 heating units equipped with 78 oil burners as well as all blowers . . . System burns about 750 gallons of oil per hour . . . Preventive maintenance important

By J. J. NOVOTNY, Chief, Facilities Engineering, The Glenn L. Martin Co.

THOUSANDS OF fuel-dollars for hot air production are being saved annually at the Martin plant, through fully automatic on-off control of the furnaces. In addition, operational refinements worked out by Plant Engineering have brought substantial man-hour economies to the year-round process which each minute moves 2,000,000 ft of dust-free, temperature-regulated, moisture-conditioned air throughout all enclosed areas of the establishment.

Just as diligently as the Engineering and Manufacturing Departments, in their spheres, have succeeded in increasing production while lowering costs, so also have noteworthy results attended the efforts of Plant Engineering to maintain an adequate heating facility at lower cost.

Continuous automatic control has been the principal line of approach. The problem embraces simultaneous control of 35 furnaces equipped with 78 oil burners, as well as the blower fans—without waste in man-hours. Controls must be so designed that the temperature can be raised and lowered with utmost flexibility throughout the building areas.

With this in mind, back in 1946, a number of manufacturers were contacted to see if they could design a type of control that would obviate the need for changing the basic setting of the thermostat at any time. Changing a thermostat at home, where only one instrument is concerned, takes little effort—but multiply that effort 35 times and enlarge the area covered some 500 times, and it will be seen that a great many man-hours could be wasted.

The heating and ventilating group was confronted with the choice, either of wasting man-hours in setting down thermostats when heat became unnecessary, or of keeping them set at a base temperature and wasting a lot of oil whenever the buildings were unoccupied. After careful study, a set of controls were designed and have been put into operation, which allow the engineers to change the temperature of the buildings from the furnace rooms by merely snapping a switch. The temperature of the factory areas is kept within the 58 F to 68 F range. The chief engineer, basing his decisions on weather forecasts, determines necessary temperatures to be maintained during the "off" periods.

The Martin heating engineers further discovered that a lot of man-hours were needed to control the speed of the blower fans that circulate the 2,000,000 cu ft load of air every minute throughout the buildings. It would be highly wasteful to run large fans at top speed when the temperature in the factory had already "satisfied" the thermostat. So, to further improve the efficiency of the heating plant, it became necessary to design a control that would operate the fans in direct relation to the furnace temperatures.

This raised another problem—that of how to maintain the proper induced draft to the burners when the fans are at low speed. To solve this, a special draft control was installed—interlocking with the fan and the oil burner controls.

This may all seem to be of small moment in terms of dollar savings—but when such an extensive heating system as this one is involved, an operational economy of 2 per cent adds up rapidly. Thus in the winter of 1946-1947, a fuel saving of $30,000 was realized.

According to a review by the Standard Oil Co., the Martin source of supply, a considerable reduction is being made in the amount of oil

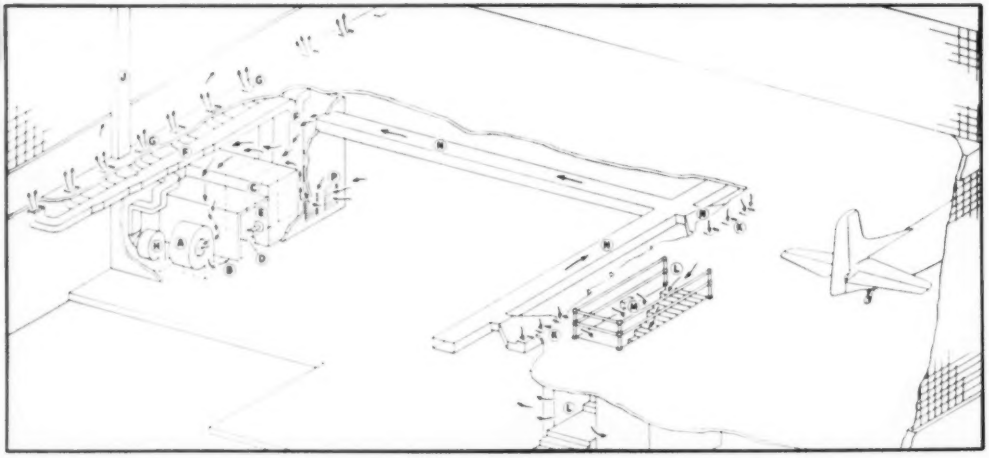


Fig. 1. General arrangement of heating system elements at the Martin Plant: A—Blower fan; B—Airfeed duct to furnace; C—Air tubes through furnace; D—Oil burner; E—Firing aisle; F—Ducts for heated air; G—Hot air floor vents; H—Flue stack fan; J—Stack for exhaust gases; K—Floor grills for returning air; L—Path of part of returning air; M—Temperature control, thermostat unit; N—Ducts returning air to heater room; and P—Intake louvers

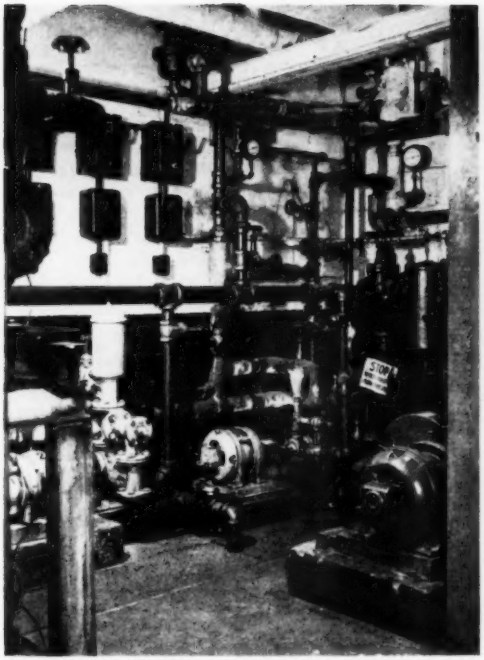


Fig. 2. View of the room containing the pumps which circulate oil from the eight 15,000 gal oil tanks

Fig. 3. Hot air floor vents, located inside the hangar doors, to offset heat loss through this part of wall

used; in comparison with earlier years. As noted above, an economy of $30,000 was effected during the season before last. In addition, an over-all saving in labor, over the same period, amounted to 60,000 man-hours.

The problem of delivering fuel oil to the plant, and distributing it throughout the maze of buildings to each furnace, has also called for attention. The oil burned here is Bunker "C". From the time it leaves the refinery, south of Baltimore, it has to be kept at least at 120 F if it is to flow.

About 750 gph must be distributed from the eight 15,000 gal outdoor storage tanks, which must also be kept at 120 F, through the pumping station to all the heaters. The miles of oil pipe must be closely paralleled by steam pipe to keep the oil moving. The oil was formerly delivered by 10,000-gal tank cars, but to gain further economies, Martin purchased tank trailers so as to take advantage of low refinery-side prices. Incidentally, the trucks hold 4000 gal each, and on cold days 4 loads are consumed every 24 hours.

Finally, a definite saving has been accomplished by the establishment of a preventive maintenance program. In off season, both the heaters and air conditioning systems are thoroughly checked and adjusted for maximum efficiency. This has often prevented costly repairs and delays.

An automatic oil system which circulates the oil in the fans was recently installed. The oil is circulated under pressure and returned and cleaned by a filter that removes all of the dirt and foreign matter.

As all stations have been made as uniform as possible, a log showing all pertinent data on the electrical set-up and operating performance enables any one of the trained Martin service men to know what to expect in case of trouble, what corrective measures to employ.

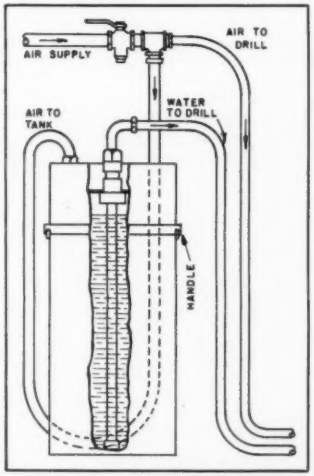
Compressed Air — Liquid Tanks For Emergency Use

Contributed by Myron C. Ziemke

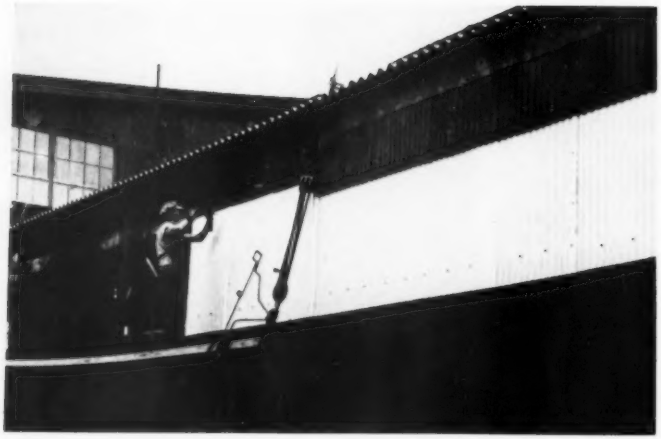
THE CONSTRUCTION of an air-supplied tank suitable for the spraying of paint or solvents or for supplying water under pressure for wet drilling when the operation takes place beyond the water main is quite a simple operation.

The tank is of 100 gal capacity rolled from $\frac{1}{8}$ in. stock and is arc welded with three openings provided in the top. Two so-called tank unions serve for the inlet of the compressed air and the water outlet respectively. The third is a 2-in. nipple supplied with a cap which serves to replenish any liquid used.

The welded-on handles serve to lash the tank to a wall and to facilitate its handling by crane or other lifting devices. If desired, a refinement may be added in the form of a pressure gauge to assist in controlling the spray use.



A pressure gauge may be installed on this liquid pressure tank when it is used for paint spraying, in order to control flow of paint. The layout, as shown, is being used for wet drilling



Inside, outside, all 'round the place . . . Skylights, sections of sidewalls, toilet doors, office partitions, light diffusing ceilings are all jobs for this versatile plastic

Fig. 1. Large sheets of 1/8 in. thick Plexiglas are impervious to corrosion, transmit light at this chemical plant. The shatter-resistant sheets are corrugated to fit Robertson metal walls of the structure to make a weatherproof job

PLEXIGLAS IN OVERALLS
will go to work in your plant . . .

INDUSTRIAL APPLICATIONS for plastics have increased tremendously during the past few years and the plant engineer now finds it necessary to keep abreast of developments in this field. In almost endless ways, plastic sheets, moldings, extrusions and laminates are proving their engineering value in modern industrial activities.

One of the most recent developments is in the use of the acrylic plastic, Plexiglas, as an industrial building material. Outstanding applications include skylights, wall glazing, inside partitions, diffusing shields for plant lighting and protective enclosures for many types of industrial processes.

Glazing Applications — Obviously, these are ideal qualifications for an industrial glazing material and it has many uses in this field. A very practical and interesting application is in the side glazing of Robertson metal buildings. In many industrial buildings the window frames, whether wood or metal, are less durable than the asphalt-covered corrugated iron of the Robertson metal

Fig. 2. Sheets of the corrugated plastic, 1/4 in. thick, serve as doors and walls of toilet booths. The translucent material insures privacy without shutting out light, and being chip-proof and splinter-proof, as well as easily cleanable, it reduces maintenance costs to a minimum. Due to its light weight such partitions are easily mounted, do not require costly or cumbersome frames and has high salvage value. The plastic does not rust or corrode from cleaning compounds

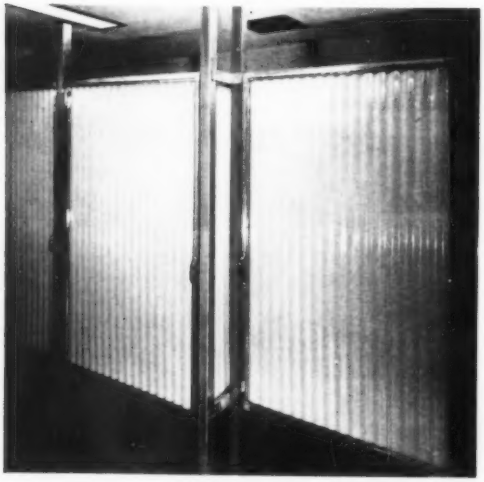


Fig. 3. Luminous ceiling as it might be used in an industrial conference room. Panels of corrugated white translucent plastic suspended below fluorescent lighting provide excellent, glare-free illumination throughout the area included. Acoustical fins extending from the angle irons that support the plastic panels cut down reverberations. Light weight (it is half as heavy as glass) combined with strength add to the plastic's desirable and also highly vesatile properties

Plant Engineering
Product Application Feature

Fig. 4. Sheets of patterned-surface plastic, 48 in. long, make attractive and practical partitions such as these installed in Cleveland office of Austin Company. The plastic is especially helpful in cases where opaque partitions would interfere with proper light distribution. Panels are easily mounted, not easily broken

OR WHITE TIE AND TAILS
...improve office looks, efficiency

siding. Rot or corrosion destroys the frames and replacement is required. Furthermore, breakage of the glass panes is, of course, a constant problem.

This plastic, corrugated to match the corrugations of the Robertson metal, solves this problem, especially in those cases where the windows are designed solely for light admission and are not intended to be opened. The ordinary window frame is removed and the corrugated plastic is installed by simply continuing the sheet across the window opening, overlapping it with the metal just as the metal is overlapped with itself over the balance of the wall. Clear or white translucent plastic may be used as desired.

Cost-wise, this type of glazing is entirely practical. A chemical manufacturer who replaced conventional sash with this type of glazing recently reports that, while the initial cost of the plastic was considerably more than glass, the total expense for sash plus installation was comparable to the cost of the plastic. Furthermore, the expense of future renewals of sash was eliminated and the annoyance of the broken panes was ended.

Flat, transparent or translucent Plexiglas panes are quite practical for replacement of glass panes in conventional frames in areas where high breakage is experienced. The original cost of the plastic panes is several times that of glass, but a saving is quickly realized through the elimination of labor and material charges for replacement.

Skylights — Corrugated Plexiglas may be used with corrugated metal roofings for skylights as well as with Robertson metal sidewalls. Skylights of this sort require no special framing or built-up openings, and, if white translucent material is used instead of the transparent plastic, there is no need for screens or light-absorbing paint to break up the direct rays of the sun. Properly designed, such skylights are strong enough to withstand the impact of hail or the weight of snow accumulations.

There are, of course, many other ways in which this material may

(Continued on page 58)

Readers who want the address of local suppliers, the name of the manufacturer, or price lists, may obtain them by writing The Editor, Plant Engineering, 53 W. Jackson Blvd., Chicago 4. Or just write "Plexiglas" on handy postcard elsewhere in this issue and send it in.

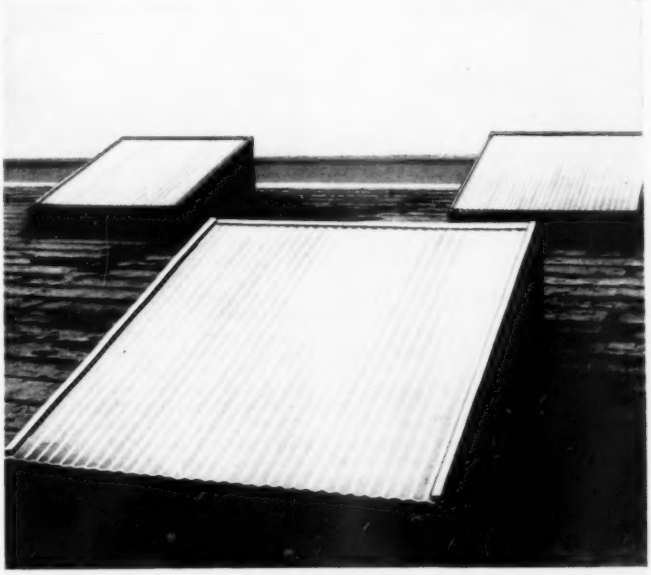


Fig. 5. This plastic is about as perfect for skylights as any imaginable material. It is light in weight, will not chip or shatter, is easily workable with ordinary tools

Factory Fire Prevention at Underwood Corporation

This plant engineer and his fire brigade have organized one of the most effective groups of fire fighters in industry . . . Equipment of the type needed, where and when it is needed; a thoroughly experienced group of firemen, well trained and well supervised are part of the secret . . . When special equipment isn't available, they make it . . . Critiques are called periodically by the plant engineer and once-a-month fire drills hold interest and build efficiency

By W. H. FISCHER, Plant Engineer, Underwood Corporation

AT UNDERWOOD Corp., we have our own Fire Brigade of twenty-two men with a chief and three assistant chiefs, whose particular job is fire prevention. With the job of protecting thirty-one buildings covering a working area of twenty-three acres where many of the operations are distinct fire hazards, our motto of "Ever Alert" has held fires to an absolute minimum.

Hazardous Materials

The working mateials which create fire hazards in our plant, in their relative order of importance, include waste paper and trash gathered by janitors and baled for salvage sale; gasoline for motor trucks fed from underground tanks through dispensing pumps in our garage and through hoses into truck tanks; Japan, lacquer and lacquer thinner, which is kept in a basement storage room; excelsior packing, chips and saw-dust, wood flour from sanding machines, and magnesium. This magnesium in turning form becomes loose, spongy material similar to steel wool or coarse excelsior, and in this form, it is highly combustible should it come in contact with open flame or sparks.

Sprinkler System

Our plant is completely covered by a sprinkler system which is our first line of fire defense. Fire in most materials can be controlled with water fog, but we provide carbon dioxide (CO_2) for situations involving lacquer, lacquer thinner, all volatile oils and gas. Magnesium turnings are protected by 3-in. tubes filled with Speedi-dri and asbestos powder in the proportion of two to one.

Our Plant Protection Chief, safety directors and guards are constantly on the alert as they visit and work in various parts of the plant looking for conditions which might cause a fire. This is our insurance against fire in the daytime. Our guard patrol, who ring boxes at night in every part of the plant, have the same responsibility. Any condition found which might lead to a fire is promptly reported to the Plant Engineer's office and corrective measures are taken.

Smoking is permitted in most places thoughout the plant except where it would create a distinct fire hazard. These restricted zones are well posted on floors and walls, and all people working in these areas are not only personally cautioned against smoking themselves, but are instructed not to permit smokers in their restricted areas.

Location of Hydrants

Fourteen fire hydrants in and about the plant include four roof stations on 8 in. risers each accommodating four 2½ in. standard hose streams. Using 1⅛ in. straight shot nozzles at our city pressure of 100 psi, we can deliver 355 gal per nozzle, per minute, or 5,680 gal of water per minute, if all four hydrants and sixteen streams were put into use at the same time by Underwood Corp. Fire Brigade.

Outside our plant, are five Underwood hydrants, one on Riverside St. and four on Woodbine St., and four city fire hydrants on Capitol Ave. and one hydrant on Cushman St., poviding twenty-four connections for 2½ in. standard hose. Several hydrants have connections for pumpers to boost pressure through several 2½ in. standard hose lines from pumping engine used by City Fire Department.

We have four 6 in. stand pipes located in various buildings each with hose rack and 100 ft of 2½ in. rubber-lined hose, connected at floor, with straight shot 1⅛ in. nozzle having a capacity of 355 gpm, and which can be used by the Underwood Corporation Fire Brigade.

Throughout our plant approximately 12,000 sprinkler heads protect each floor of each building. These are supplied from city water mains and controlled by indicator posts located in and about the plant. If, through an emergency, the city water supply should fail, we have a reserve supply of 550,000 gal in our stand pipe. We can replenish this through two 1500 gpm electric pumps with suction from city main to pump delivering to the 550,000 gal stand pipe at 90 psi. By changing valves and using pumps in tandem, we can deliver direct into supply lines boosting pressure above normal city pressure at 135 psi at 1500 gpm, which would accommodate approximately five 2½ in. standard fire hose with 1⅛ in. straight shot nozzles with almost no loss in pressure.

It requires three able bodied men to hold one 2½ in. straight shot nozzle at 90 psi delivering 355 gpm, it would take at least four to hold a 2½ in. nozzle at 135 psi.

All record vaults are protected with Underwriter's approved carbon tetrachloride bombs actuated by 165 F fuse which, when released by heat, actuates a spring loaded pellet causing a firing pin to strike the percussion cap of a .38 calibre blank cartridge. This explosive pressure bursts the one quart glass bottle releasing the carbon tetrachloride, which combats the flame by direct contact, wetting the base and extinguishing the fire, or by the generation of gas when the liquid contents of bomb are dispersed and mixed with hot gases generated by blazing material.

Protection of Vaults

Recently we completed the installation of a protective device for the vault where we store lacquer and lacquer thinner, both highly combustible and explosive. After investigating a number of procedures we decided upon using nine Fire Tox Bombs with carbon tetrachloride plus ammonia, as the extinguishing medium. The bombs are placed under and above two shelf racks built on three sides of room. Any heat generated will cause bomb release to discharge at 165 F at that particular location. In case of explosion, all heads would discharge simultaneously in this closed room.

We use 2,200 ft of 1½ in. double jacketed rubber lined 400 psi hose, divided among seven fire carts throughout the factory. We have

designed and developed our own fog nozzle for 1½ in. hose, using discarded nozzles from 1¼ in. cotton mill hose. This required reaming out 1¼ in. pipe thread and retapping for 1½ in. pipe thread, and plugging the nozzle solid. Suitable holes were drilled to permit five small converging streams to meet equidistantly and break the solid stream into a fine mist approximately 5 ft wide by 16 ft long. This mist, solid circular in shape, is capable of combating volatile oil fires and can be used on any other fire, not requiring a solid stream for cutting, as would be required for a fire having a compact base such as baled paper, cotton, excelsior and boxes.

This nozzle is preferred by our Fire Brigade due to the wide spread of the stream delivered and the great efficiency of the stream. It uses a small amount of water efficiently, whereas, with a solid stream, puddles of water immediately form under the stream. With the fog nozzle general wetting results, with not too much water to damage goods or equipment collecting below. The small amount which does pool up can be controlled with sawdust and salvage covers.

Extinguishers

There are 185-2½ gal acid and soda fire extinguishers placed in the various departments in the plant.

These are placed at strategic points where they will give the best protection against general fires which might be caused by spontaneous combustion of rags, cotton waste, overalls, paper cartons or any fire not caused by a volatile oil with combustible base.

We have forty-three Foamite extinguishers of the usual 2½ gal size placed where japans, lacquer, varsol, benzine, lacquer thinner or shellac may be used. In addition to this protection, we have had for many years a 50 gal Foamite cart which is centrally located. This unit, on 4 ft diameter wheels, can be wheeled very rapidly from one locality to another, thus having great flexibility and mobility.

Smoking is not permitted in any area where magnesium is machined. Water is not proper for use on magnesium fires, so we have tried various materials and found Speedidri, two parts, with dry asbestos cement, one part, to be the best extinguisher. We designed containers 3 in. in diameter of sheet-metal, 48 in. long, filled with this material and hung on adjoining posts. In case of fire this material is poured on the flame, smothering it. These tubes are made long in order to permit placing material directly on the fire without scorching the person.

We have some 500 or more pails suspended from posts and walls throughout the plant, some filled with water and some with sand. Pails are painted red and stencilled for "Fire Only." These are placed in strategic localities, very close to heavy traffic aisles, so that constant inspection and supervision of the contents of these buckets or pails is a simple matter.

Fire Cart Equipment

Each of our Fire Carts has a reel with 150 ft of 1½ in. double jacketted gum rubber lined fire hose, having a capacity for 400 psi. These hoses are in three lengths, male and female couplings, are wound on the reel all coupled with a nozzle at the end for fast operation. Where we have a fire which requires two streams, or two sources of water, we have a Siamese connection on each truck which will permit two streams of water within 100 ft of the hydrant to be used simultaneously. We have two fog nozzles of the 1½ in. type on each truck and one 1½ in. straight shot nozzle.

In the center-well of the truck we have one 4 gal pump spray type extinguisher, filled with water, which is to be used for spontaneous combustion fires in corners, between beams and walls, or between floors and walls, crevices of floors, where a little liquid will do the necessary work without flooding or damaging anything beneath.

Inside the truck there is an 8 ft hook for use in breaking windows, tearing out sash, ripping down burning shades, cutting down exposed wiring which is overheated, or any other fire caused by fabric, paper, or wood, which, by tearing down, will extinguish rather than throw several streams of water to do the same job. All of this work which these tools will do are assumed. We have had no use for any of the tools which we have defined, outside of the fog nozzle. We have the usual 3½ lb fire axe with a spike head, a 6 lb sledge hammer, 4 ft wrecking bar, 4 ft point bar and 4 ft pinch bar. We also have a 4 lb CO_2 fire extinguisher under cover which is to be used for all electrical fires around switchboards, control boxes, motors, generators, gasoline fires or fires on electric trucks. These carbon dioxide extinguishers extinguish by lowering of temperature of the fire below the combustion point. They are also extremely handy in and about automobiles and motor trucks. We have one 10 lb CO_2 extinguisher on wheels located in our main garage on Woodbine St. for potective use on our motor trucks.

In the fire trucks there is, also, a steel miner's pick with 10 ft of chain attached to enable the firemen to break into any door or partition behind which a fire may be blazing. This gives an excellent purchase and with the chain sufficient manpower can be employed to tear down walls or doors to permit access for fire brigade equipment.

Another piece of equipment is a cart with 100 ft of hose on a reel, three extinguishers in place of five, same types and size as the others, and with the same other equipment This truck had to be made several inches shorter than the standard trucks to permit access to the various floors, where larger equipment would be hindered by elevator size.

A red-painted salvage cart carrying four 40 gal cardboard barrels contains sawdust, brooms, shovel and several waterproof canvas covers of various sizes to spread over machines and equipment underneath where a fire might be raging.

Another truck contains six 20 ft by 30 ft salvage covers in case of damage from sprinklers, breaking of water pipes, or damage to the roof permitting rain or snow to get in. This is especially intended for the breakage of skylights, wherein severe damage can be suffered unless our property is promptly covered. We have eight fire houses with 200 ft of hose in each.

One fire drill is held each month, place undetermined. The actual fire alarm is rung and the truck in the locality responds and the 1½ in. hose is used with water in each case. Where possible a clamp, which was designed to shut off the water at the nozzle, is used to permit the changing of nozzles with the pressure on, just as in the municipal fire departments. Where possible we use Siamese connection to give more men an opportunity to handle nozzles. In other words, one stream may be a fog nozzle and the opposite have a solid stream.

Fire Drills

Our average time, from the ringing of the fire alarm to the actual water on the fire, is from 2 to 3 minutes. This time has been clocked.

Our Fire brigade is extremely efficient and well trained. E. B. Coughlin is Fire Chief, R. J. Page, 1st Assistant Chief, J. M. Carlson, 2nd Assistant Chief and C. A. Schmidt, 3rd Assistant Chief.

Anything out of the ordinary noticed by the Plant Engineer, either as to speed of operation, or efficiency in handling equipment in actual fires, the method of getting the equipment into the room and getting the smoke cleared out are all subjects for critiques. From these we either revamp the operation or extend our instructions to cover the part complained of. From these critiques our Chiefs and the Foremen of the carts receive their best instruction, being able to point out why certain things cannot be done in certain ways, and a vote is taken on the best method of operation. This method has been in use for several years and works most successfully. Everybody has an opportunity to present his ideas, and if they are worth considering, a trial is given, and if that is successful, adoption of the idea follows.

Instrument Installation and Maintenance

By GEORGE A. LARSEN, Instrument Engineer

SINCE instruments are a must item in the modern refinery, we have felt the need for an organized and independent Instrument Department whose function is to specify, install and properly maintain the plant instrumentation; and whose direct responsibility is to insure accurate and economical operation of this equipment.

In an effort to improve departmental and equipment efficiency we have adopted certain standard practices and procedures which may be of some interest to others. It will not be possible to discuss all of these practices, so only those of major importance will be mentioned.

One of the most important Instrument Department requirements is a well-equipped shop, centrally located with respect to the operating units. Good illumination for night or day work is important because a refinery Instrument Department operates on a 24-hour schedule. Our instrument repair shop has excellent natural lighting for day operations, while fluorescent lighting over the worktable provides sufficient illumination for the night shift.

The large worktable is covered with ¼ in. steel plate to permit the better handling of heavy equipment such as valves and flowmeters. One end of the workbench is equipped with two flowmeter test racks and the necessary manometers, air connections, regulating valves and provided with drip pans to catch all spilled mercury.

Safety is an item of primary importance to the Instrument Department personnel. They are instructed in the safe handling of mercury, inflammable liquids and the servicing of flowmeters for hot oil, light hydrocarbon, custic and acid. Metal safety hats are worn when working in areas where falling objects may cause an injury. Each member is issued a pair of goggles which he keeps available for use when required. Monthly safety gang meetings help maintain interest in the safety program and produce many worth-while ideas.

The shop tool locker includes such special items as pneumatic drill motor, for use in hazardous locations, electric drill motor, pneumatic impact wrenches for valve work, saw gun for panelboard cutouts, rotary saw for circular cutouts, tubing tools and many other similar items commonly used for instrument installation and maintenance.

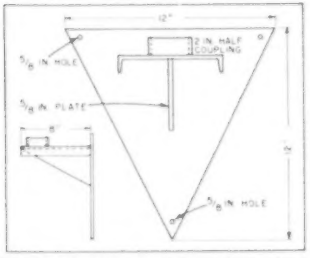


Fig. 1. Standard wall bracket for flowmeters and transmitters. These are kept on hand as stock items and eliminate the past practice of assigning steel men or pipe-fitters to mount the instrument, using a bracket of their own individual design. The mounting height is a standard 42 in. from the floor to the top of the bracket

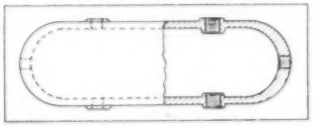


Fig. 2. Standard type seal pot or trap used in all services except some very special installations

The standardization of various items and meter piping arrangements has done much toward improving departmental and equipment efficiency. The meter piping arrangements have been drawn up with a separate sheet available for each type of installation. A man going out on an installation takes a sheet with him for checking.

The importance of control-valve maintenance must not be overlooked. The control system is no better than its control valves. These devices require perfect alignment, correct packing, proper lubrication, a good diaphragm, correct type of inner valve and must be responsive to slight loading air changes on the diaphragm. A trained instrument mechanic should always be assigned to the maintenance of this equipment.

Control valves of large size or those requiring rapid response or amplified air pressure are equipped with air relays or booster pilots.

Pneumatic control equipment must have an adequate supply of clean dry air for trouble-free operation. We have made extensive improvements in the instrument air system to provide a satisfactory air supply. Each operating unit is equipped with air scrubbing equipment and auxiliary air compressors to take over in case of plant air failure. These compressors float on the air line and cut in at a predetermined minimum air pressure.

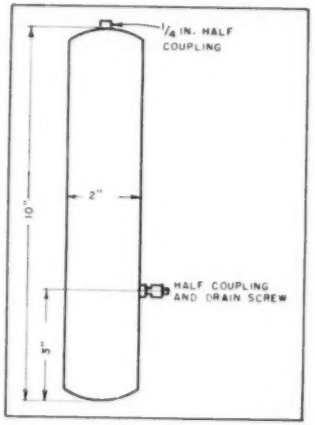


Fig. 3. Detail of construction of standard mercury and sediment trap used when required

Among the numerous special items worthy of mention are the pH recorders and controllers, gas analyzing equipment and the Penetron.

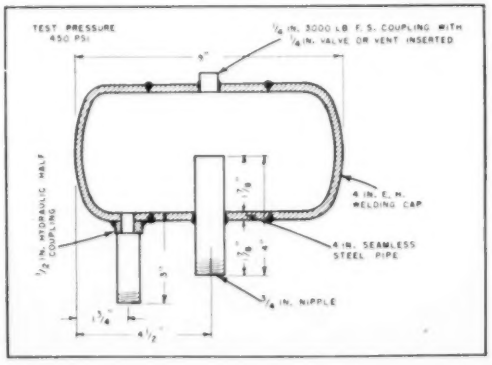

TEST PRESSURE 450 PSI
1/4 IN. 3000 LB F.S. COUPLING WITH 1/4 IN. VALVE OR VENT INSERTED
5"
1/2 IN. HYDRAULIC HALF COUPLING
4 IN. E. H. WELDING CAP
4 IN. SEAMLESS STEEL PIPE
3"
3/4 IN. NIPPLE
1 1/4"
4 1/2"

Fig. 4. A special type steam flowmeter condensing chamber especially suitable for low steam pressure services

The determination and control of pH is important wherever water or water solutions are used. The modern refinery is continually discovering new benefits and new economies through the utilization of pH instruments. The instrument men are instructed in the servicing of this equipment of which a daily check is required, at which time the cells are carefully checked with a buffer solution that is verified by the plant laboratory technicians.

The Penetron is an instrument developed by The Texas Company and used in the refinery for the determination of wall thickness of lines, vessels and tanks. It accomplishes this function with a high degree of accuracy by the use of penetrating gamma rays.

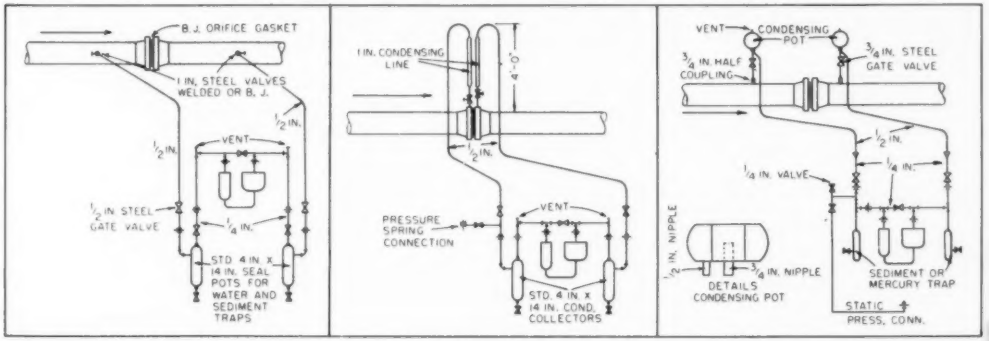


Fig. 5. Left: A typical meter hookup for hot recycle gas oil using the seal chambers as sediment and water traps. With this type of connection the manometers remain clean for long periods and are unaffected by sediment and water accumulation. Fig. 6. Center: A typical installation for metering wet gas. Note the four-foot risers above the orifice and condensate collectors below the flowmeter. Fig. 7. Right: A recommended hook-up for low-pressure steam. The top connected condensers with 3/4 in. drain-back lines make the installation simple, economical and quite satisfactory for low-pressure service. Since the line flanges are standard series 15, vena contracta taps are used

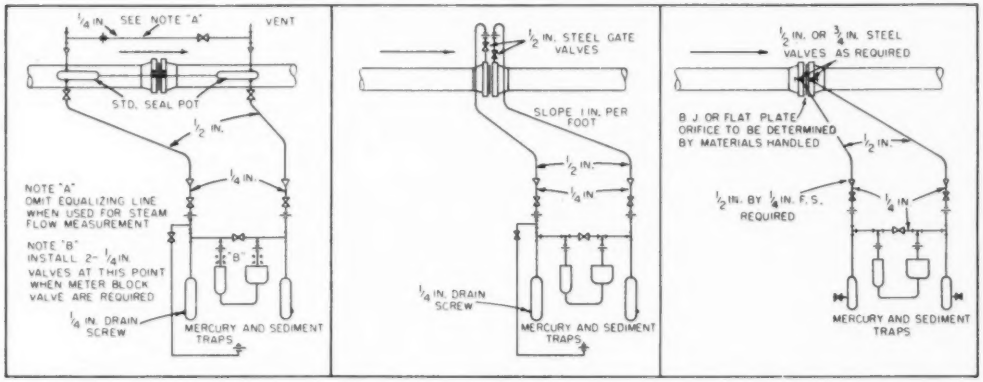

1/4 IN.
SEE NOTE "A"
VENT
STD. SEAL POT
1/2 IN.
1/4 IN.
NOTE "A" OMIT EQUALIZING LINE WHEN USED FOR STEAM FLOW MEASUREMENT
NOTE "B" INSTALL 2- 1/4 IN. VALVES AT THIS POINT WHEN METER BLOCK VALVE ARE REQUIRED
"B"
1/4 IN. DRAIN SCREW
MERCURY AND SEDIMENT TRAPS
1/2 IN. STEEL GATE VALVES
SLOPE 1 IN. PER FOOT
1/4 IN. DRAIN SCREW
MERCURY AND SEDIMENT TRAPS
1/2 IN. OR 3/4 IN. STEEL VALVES AS REQUIRED
B. J. OR FLAT PLATE ORIFICE TO BE DETERMINED BY MATERIALS HANDLED
1/2 IN. BY 1/4 IN. F.S. REQUIRED
MERCURY AND SEDIMENT TRAPS

Fig. 8. Left: An alternate method of connection when measuring butane, propane, pentane, when seal pots are required. Fig. 9. Center: Shows a typical hook-up for dry gas or air metering. An extra bleeder valve provides a connection for the static pressure check gage. Fig. 10. Right: Meters for fluid measurement not requiring seal pots

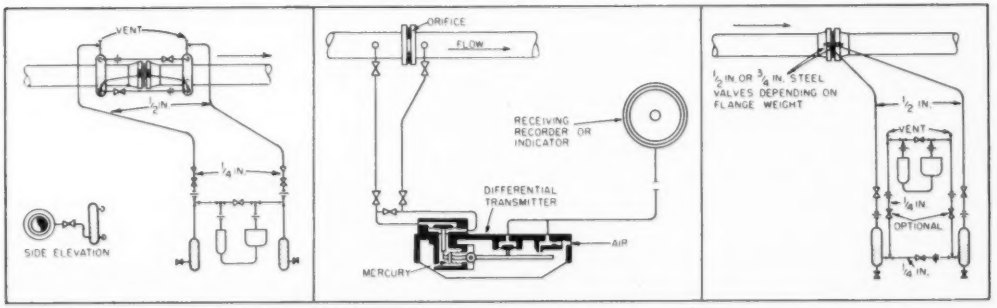


Fig. 11. Left: Numerous types of seals and hook-ups are used in the flow measurement of caustics and acids. Fig. 12. Center: Special arrangement of differential transmitter flow measurement system for sulphuric acid service. Fig. 13. Right: The method used when it is desirable to install seal pots below the flowmeter when flowing medium is lighter than sealing medium

How to Start a PM Program for ELECTRIC DRIVES

Part II*. What inspection and servicing items must be considered . . . Check list of items . . . Classification according to importance and frequency of attention . . . Importance of supervising the inspector . . . Field records and their use . . . Detailed instructions for work

By **MARION A. JENSEN**, Consulting Engineer

ONE OF THE most important factors in a preventive maintenance program is a clear understanding of the primary objective and the purpose of periodic inspection of equipment. This is to insure a thorough check of all physical factors relating to operation, servicing and maintenance in advance of serious trouble. At the same time it is necessary to scrupulously avoid any service in advance of actual need. The success of such a plan depends upon the fidelity and judgment of the inspector.

As an aid to inspectors, Table IV has been prepared as a check list of inspection and service items that must receive periodic attention. Table V is a rearrangement of these items to assist inspectors in determining the relative importance of items under average condition. The various items are classified in three groups, A, those requiring attention most frequently; B, those second in frequency importance; and C, those requiring attention least frequently.

Under no condition, however, should any of the items followed by a numeral be deferred for a greater number of inspection periods than the numeral denotes. For instance the numeral 1 (directly following Item I a. Dust—1. of Table V) means that, if at the time of inspection excessive dust is not in evidence in the windings, cleaning may be deferred for not more than one inspection period.

Those so designated constitute service items. Those not so marked are maintenance items. On these, inspection will determine the need of further attention. For example, if excessive clearance in a sleeve bearing is non-existent then obviously the replacement of such a bearing may be deferred indefinitely. Conversely, however, regardless of the condition of the bearing lubricant, it should be renewed and the bearing thoroughly cleaned at intervals not exceeding alternate inspection periods.

The same may be said in connection with ball and roller bearings. This should be disassembled sufficiently to insure detection of chipped and cracked balls and rollers. This should be done at suitable intervals regardless of whether or not satisfactory clearance is indicated by the inspection.

The above covers all elements of a maintenance program with the exception of field reports or service records. At the time of the initial servicing of the equipment great care must be taken to cover every detail and an accurate record made on a field report. These field reports should be made at the time of each subsequent inspection.

Because of space limitations an example of a typical field report blank has been omitted. These reports can be made on letter sized paper preferably punched for a ring binder. They should carry vertically the check list shown by Table V. There should be sufficient space and definite columns for notation by the service man of the "Condition As Found," "Corrective Action Taken" and "Remarks." Each sheet should be identified by the shop number of the piece of equipment, the inspection item or items covered, color symbol, date of servicing and signature of the service man.

These records should be filed after transferring the necessary data to the permanent record card (Fig. 1 of Part I). At the same time, the scheduled date of the next inspection should be entered on the card. A glance at the card will then give one all pertinent information such as Identification of the Motor, Classification of Type of Service Rendered, Date of Last Inspection and Date of Next Inspection.

Inspection schedules can and should be made in advance to spread the work and keep the crews busy. The permanent record cards give a summary of the service record of each machine, while detailed records are available from the field reports. These should be filed chronologically by shop number.

Detailed instructions for performing the inspection and servicing items covered by Table IV follow. For easy reference these instructions are in the same order and bear the same designation as in the table.

INSTRUCTIONS for INSPECTION and SERVICING

A-C Induction and Synchronous Motors

1. **INSPECTION—CLEANING**

a. **Dust**—Motors and control equipment must be maintained free from dust. Usually this may be accomplished by the use of a blow gun supplying clean dry air at 40 to 50 lb pressure. Care must be used. It is usually best to work from the drive end of the motor. Blow onto the windings, straight through parallel to the shaft. This blows the dust from the drive side out of the motor into the air gap and through to the opposite side.

A flashlight should be used simultaneously. A final blowing can be given from the opposite end of the motor. This time apply the air jet radially to the periphery of the stator frame and windings. The object is to dislodge and blow off at a tangent any dust lodged in the windings or rotor at this end of the motor. In the case of splash proof or of semi-enclosed motors, it may be necessary to remove the outboard end housing in order to facilitate cleaning operation.

b. **Oil**—Check carefully for accumulation of oil or grease on the stator, windings, bottom of frame, in the rotor (especially of the wound rotor type) and in the air gap. Oil is the arch enemy of insulation and is the cause of the major percentage of insulation failures.

Oil which is not removed in the process of blowing the dust should be removed by means of an air spray gun utilizing carbon tetrachloride or some non-toxic cleaner. Operate in the manner described for the removal of dust

* This is the conclusion of a two part article. Part I on p. 28 of the June issue dealt with the initial phases of setting up a preventive maintenance program, classification of drives according to operating schedules and types of service as well as the details of an equipment card record.

after surfaces have been thoroughly saturated with the cleaning compound.

It may be necessary to repeat this procedure several times before satisfactory results are obtained. If the accumulation is of long standing, the motor may have to be removed from service, completely dissembled and the windings thoroughly cleaned. It should then be treated with an application of good insulation varnish, by spraying or dipping, and baked, the procedure depending upon the particular varnish used.

The object is to remove oil from the surface, and more important, remove it from all openings or crevices between the coil sections.

c. **Foreign Matter** — Foreign matter other than dust or oil, usually deposits from the particular process or machine which the motor serves, is often difficult to remove. If the deposit adheres firmly and resists blowing or brushing with a stiff bristle brush a solvent not injurious to the insulation must be used. Preferably this should be a non-inflammable non-toxic type. In these cases work with the Safety Department.

d. **Moisture** — The presence of moisture in appreciable quantities means disassembly of the motors and a thorough drying. In certain cases temporary relief may be afforded by a portable motor driven blower to force dry heated air through the motor.

Where perceptible moisture is present make a check on insulation resistance by means of the AIEE Standard Method or Megger. The motor should be disconnected from ground and checked both before and after the drying process. For safe operation the insulation resistance should not be below 1 meg-ohm where the line voltage is 1000. Where line voltage is below 1000, the meg-ohms may be reduced in proportion to a minimum of 0.10 meg-ohms at 100 v.

c. **Damaged Insulation** — Windings should be carefully checked after performing of a, b, c, and d. Frayed or bare spots on insulation should be touched up with a high grade air drying insulating varnish by means of a brush or spray gun.

2. **INSPECTION—Lubrication and Bearings.**

a. **Air Gap**—Check the air gap at four equidistant points of the periphery, namely, top, bottom and both sides. If lower air gap is less than 5 per cent of normal at the lower side bearings should be given attention. On large machines with pedestal bearings, discrepancies in any direction may be compensated by the adjustments provided or by shims. An inequality in air gap greatly magnifies the "magnetic pull" on the discrepant side and tends to further aggravate bearing wear.

b. **Bearing Wear**—As a double check on air gap measurements, check bearing clearance in the following manner. This applies to all sizes of motors or generators where the weight of the rotor is such that it can be readily lifted by means of a bar with a suitably placed fulcrum, first at one end of the shaft and then at the other.

The clearance in the bearing can be judged by an experienced person by noting the amount of play (vertical movement) of the shaft. Where extreme accuracy is desired, clamp a dial indicator gauge to the bearing housing in such a manner that dial indicates 0 with shaft in normal position. Any upward movement of shaft will register on the dial indicator.

By comparing the readings with air gap inequality readings it is possible to determine what proportion of wear or inequality of air gap reading is due to bearing wear and what proportion is due to mal-alignment of the bearing pedestal or shell. The latter applies only to large size units where bearings are supported separate from the housings.

Ball and roller bearings of small and medium size units must operate with an almost imperceptible clearance. On units above approximately 75 hp, it is

Table IV. Check list of inspection and servicing items. In Table V these items are rearranged in three groups according to the need for frequency of attention. Detailed instructions for performing each operation are given in the text

AC Induction and Synchronous Motors

1. INSPECTION—Cleaning
   - a. Dust
   - b. Oil
   - c. Foreign matter
   - d. Moisture
   - e. Insulation
2. INSPECTION—Lubrication and Bearings
   - a. Air gaps
   - b. Bearing wear
   - c. Bearing lubrication
3. INSPECTION—Windings
   - a. Insulation resistance
   - b. Slot wedges
   - c. Drying windings
   - d. Insulation varnish
4. INSPECTION—Drives
   - a. Fastenings
   - b. Belts
   - c. Couplings
5. INSPECTION—Load Test
   - a. Voltage, amperage, wattage and power factor

DC Motors and Generators

6. INSPECTION
   - a. Brush gear
   - b. Commutator

Controls—AC and DC

1. TESTING—Insulation
   - a. Coils
   - b. Cleaning windings
   - c. Drying windings
   - d. Repair of wedges
   - e. Insulation varnish
2. INSPECTION—Mechanical Features
   - a. Contacts
   - b. Mechanical action
   - c. Terminals
   - d. Relays
   - e. Cases

Table V. Inspection items from Table IV rearranged in three groups: A items requiring most frequent attention; B items requiring attention next frequently; and, C items requiring attention least frequently

A—Items Requiring Attention Most Frequently

AC Induction and Synchronous Motors

1. INSPECTION CLEANING
   - a. Dust—1
   - b. Oil—0
   - c. Foreign Matter—1
   - d. Moisture—0
2. INSPECTION—Lubrication and Bearings
   - c. Bearing Lubrication—1
4. INSPECTION DRIVES
   - b. Belts

DC Motors and Generators

6. INSPECTION
   - a. Brush Gear
   - b. Commutator

Controls—AC and DC

1. TESTING
   - b. Cleaning Windings—1
   - c. Drying Windings (as needed)
2. MECHANICAL FEATURES
   - a. Contacts
   - b. Mechanical Action

B—Items Requiring Attention Next Most Frequently

AC Induction and Synchronous Motors

2. INSPECTION—Lubrication and Bearings
   - a. Air Gap—1
   - b. Bearing Wear
3. INSPECTION WINDINGS
   - c. Drying Windings (as needed)

Controls—AC and DC

2. INSPECTION—Mechanical Features
   - d. Relays

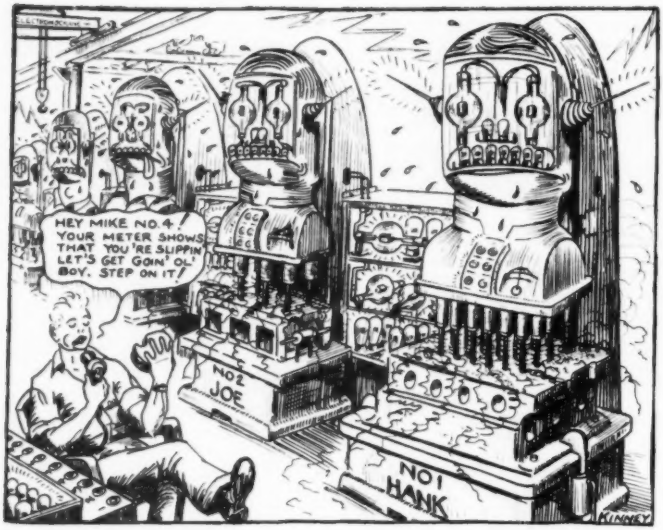
C—Items Requiring Attention Least Frequently

AC Induction and Synchronous Motors

1. INSPECTION CLEANING
   - e. Insulation
3. INSPECTION WINDINGS
   - a. Insulation Resistance
   - b. Slot Wedges
   - d. Insulation Varnish
4. INSPECTION DRIVES
   - a. Fastenings
5. LOAD TEST
   - a. Volts, Amps., Watts and Power Factor

Controls—AC and DC

1. TESTING
   - a. Repair of Coil Fastenings
   - e. Insulation Varnish
2. MECHANICAL FEATURES
   - c. Terminals
   - e. Cases



Automatic equipment—fine for the operator—rough on the plant engineer's budget

possible to continue operation with 0.001 or 0.002 in. clearance in the bearings. If more than this amount of play is present on ball or roller bearings, it indicates that serious wear has taken place and bearings should then be removed and disassembled.

If inner and outer races are found reasonably free from wear, substitution of new balls or rollers may be sufficient remedy. In some cases, replacement of one or both of the races may be needed. In case of doubt replace the complete bearing with a new one. In the case of sleeve bearings, either bronze or white metal, greater clearance is permissible. This is due to the lubricant which creates a film which tends to keep the rotating shaft more or less concentric with the center line of the bearing. For shaft diameters up to 1 in. a clearance 0.001 in. should be the maximum permitted. From $2\frac{1}{2}$ in. to 4 in. diameter as much as 0.003 in. clearance is permissible although not desirable.

c. **Bearing Lubrication** — All bearings, roller or sleeve type, should be thoroughly cleaned of lubricant and then flushed with a suitable flushing compound. Kerosene is quite suitable for this purpose. At this time shaft seals should be checked. If found worn to an appreciable extent they should be replaced. Oil rings should be checked to make certain they are not worn with a burr on the edge and have suitable clearance for turning freely with the shaft.

Bearings should then be refilled to the proper level or quantity depending upon the type of lubricant indicated by the lubrication chart.

3. **INSPECTION—Windings**

a. **Insulation Resistance**—Check the insulation resistance to ground by means of AIEE Standard Method or a Megger. Before this check make certain that motor is completely disconnected from the line and clear of all grounds. If the insulation checks below 1 meg-ohm windings should be disconnected at motor terminal block. If this fails to improve the situation the windings should be separated.

Groups should be separated at star or delta connections and then each phase group checked separately. The faulty section should be carefully examined for possible defects. If these are not located it would be necessary to place the motor in a suitable drying oven and thoroughly dry out the winding.

In the case of a motor too large to conveniently handle in this manner it is possible to apply a current at approximately $\frac{1}{4}$ of the normal operating voltage after reconnecting the phase groups and gradually build the amperage up to the overload limit of the windings. This will generate sufficient internal heat to eliminate any possibility of low insulation resistance due to dampness.

After a reasonable period of drying the resistance check should be repeated. If this shows no improvement remove the slot wedges from the faulty group and carefully examine coil insulation in the individual slots until the faulty coil is found. Suitable repairs should then be made and coils and connections replaced.

In extreme cases, it may be necessary to completely strip the coils from the core and reinsulate. Such conditions occur when a motor has been subjected to long periods of overload which gradually bake the life out of the insulating material. In the more modern types of insulation where mica or glass has been used such conditions cannot readily occur.

b. **Slot Wedges** — Carefully check all wedges to make certain they are tight in the slots.

c. **Dry Windings** — Thoroughly dry out windings as described in 3 a.

d. **Insulation Varnish**—Dip or spray windings as indicated under 1 b.

4. **INSPECTION—Drives**

a. **Fastenings**—Carefully check motor fastenings. All feet must rest firmly on bedplate slide rails or foundation. Bolts should be secured. Motor should be level on both the longitudinal and transverse axis. Where a motor rests on a hinged base which acts as a belt tightener the motor will be out of level on the longitudinal axis.

b. **Belts**—If drive consists of V-belts, carefully check grooves of both sheaves by means of a suitable gauge. If much wear is present in grooves, the sheave should be refaced if sufficient stock remains to permit this. If not, the sheave should be replaced for worn grooves will quickly ruin a perfectly good belt. Center lines of respective grooves of driving and driven sheaves must be in alignment. Vertical axis of faces of drive and driven sheaves must be in alignment.

A certain amount of float or end play, depending upon the size of the unit, should be present in the motor shaft. The position of the motor with respect to the driven machine must be such as to permit an equal amount of the float to be present on each side of the center line sheave to driven sheave. A sufficient degree of tension should exist in connection with V-belts to insure the belts being perfectly taut when the drive is idle.

The best method is to draw the belts up to a point where they are extremely taut, then slack off sufficient so that belts are still taut but when thumped with the hand possess an active degree of "springiness." Occasionally one or two belts in a group will be less taut than the others. Such belts should be carefully checked. If found defective they, or preferably the entire set, should be replaced. The best belts of the set removed may be preserved for emergency use.

Belts should be carefully checked for overload. V-belts will not operate satisfactorily under overload conditions. If permitted to slip continuously both belts and sheaves will soon be ruined. The best conditions are realized when belts are operated at not greater than 75 or 80 per cent of full load rating. Belts should be kept free from excessive dust, oil or grease conditions.

The same conditions apply to flat leather belts with the exception that no grooves are utilized. In the case of a flat belt it is important that splices be properly made. Belts should be kept in a pliable condition by the use of a belt dressing compounded from Neat's-foot oil and free from sticky or tacky substances. Under no condition however should dressing be used on V-belts.

c. **Couplings** — Due to the large variety of couplings in use it is difficult

(Continued on page 57)

Safer, Better Light for Paint Room

By **DUNCAN PRESTON**, Detroit Edison Co.

Paint spraying operation necessitated high degree of shadowless illumination combined with safety from explosive vapors . . . Low insurance rate for the company depended on compliance with inspection service requirements . . . Ease of maintenance and economic factors also entered into considerations . . . Now, cleaning can be done solely with a razor blade without use of solvents

THE CHAMBERLIN Company of America, Detroit, recently was faced with the need for redesigning its paint spray room lighting installation. The spray room was 12 by 15 ft in size with a sloping roof of heavy gage sheet metal. The old lighting installation consisted of five 150 w incandescent fixtures of the explosion-proof type which provided 10 ft candles of light. This degree of illumination was insufficient for the operation involved.

In addition, the Michigan Inspection Service recommended the removal of the equipment because it did not meet its safety requirements which, in turn, determined the insurance rate. The basic reason for the requested change was the high surface temperature of the fixtures and the difficulty of removing paint from the surfaces.

Therefore, the problem resolved itself into the following components: 1. To provide a high level of illumination to permit rapid application of paint and inspection of the product for defects in coverage. 2. To provide diffuse illumination to reduce shadows and minimize glare in the operator's eyes. 3. To comply with safety regulations of the city electrical inspector and of the Michigan Inspection Service. 4. Be easy to maintain. 5. Meet enonomic considerations of fixture and installation costs.

Final plans, which called for installation of five fixtures bearing Underwriter's approval for types E, F, G dust-tight and vapor-proof applications, were submitted to inspection authorities and were approved. The fixtures were equipped with high-stress glass lenses having a shock resistance of 8 ft lb.

Rectangular openings were cut in the ceiling of the spray room and these openings were framed with angle iron. The fixtures were then set in the frames as indicated in Fig. 1. Soft lead gaskets were provided to prevent passage of explosive vapors through the fixture openings.

When the operator prepares for the paint spraying operation he first coats the flat glass surface of the fixture lens with a clear liquid wax. This enables him to easily remove the accumulated paint by scraping the surface with a razor blade. Thus, the use of inflammable solvents is avoided and better lumen maintenance is assured. An access door in the side of the fixture provides means for servicing the ballasts and lamps from outside the paint room.

This is one of the Winning Merit Award entries from the competition sponsored by the Third International Lighting Exposition.

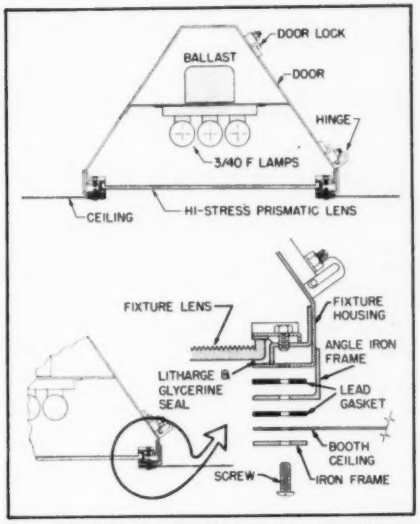


Fig. 1. Details of construction of the fixture showing use of seal which prevents passage of explosive vapors

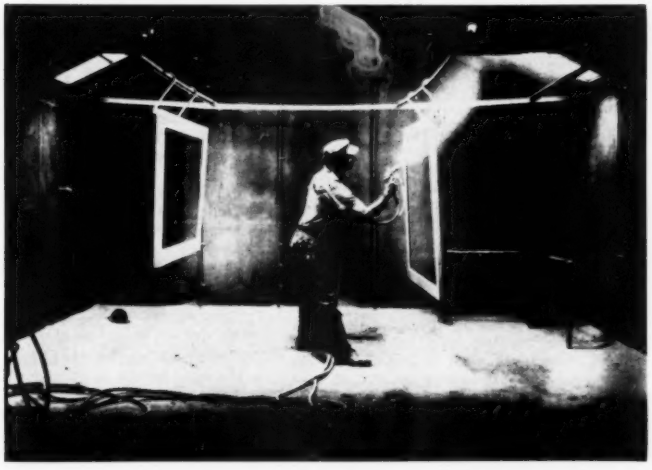
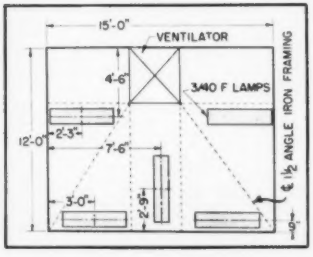


Fig. 2. Absolutely shadowless illumination is provided on work surfaces in the paint spray room. Total wattage in the room is 750 which provides an average illumination of 85 ft candles

Fig. 3. This plan view of the paint spray room shows location of the five lighting fixtures and the ventilator. Dotted lines indicate centerlines of angle iron framing



Should Maintenance by Contract Be Encouraged?

1. The British Point of View

Is contract maintenance desirable? . . . Does it meet a real need? . . . Does it detract from the plant engineer's status or build up his management opportunities? . . . Members of the IPE* debate these questions heatedly . . . General conclusions—it's here to stay! . . . But the extent and degree to which it's desirable remains indefinite for in the shuffle maintenance was side tracked . . . The subject does however deserve very serious thought, attention and discussion

MAINTENANCE by contract is controversial but is not new, novel or rare. In it's broad aspect it may be considered any work not accomplished entirely by the regular employees. It may involve: sending work out; bringing an outside force in; employment of special supervision only; or some combination of these three. Payment may involve a contract, a purchase order or simple agreement based on a lump sum or fixed fee or perhaps some cost plus arrangement.

Furthermore, it is often difficult to draw a clear cut distinction between maintenance, certain phases of operation, and, expansion or rearrangement activities. A relatively simple plant rearrangement in which maintenance, repair and reconditioning is often a major factor may well involve: an architect; a consulting engineer; several contractors; manufacturers' service representatives supervising the installation or rebuilding of specific equipment; machines or instruments returned to the factory for reconditioning; rental of construction equipment; and perhaps a caterer supplying meals.

In some degree this practice is followed continuously by all plants and companies, the extent of the outside work depending upon company policy, size and type of the organization, condition of the labor market, business conditions and, of course, geographical location. Contract work is thus a well established, almost an indispensible, part of plant engineering.

In a more limited sense, Maintenance by Contract is often a definite company policy wherein certain periodic but infrequent work, which requires special equipment, knowledge or skill, is performed by outside concerns or specialists. Construction work, heat exchanger** maintenance, furnace linings, motor rewinding and elevator maintenance are perhaps the most common examples. Enterprising individuals have, however, built up more localized businesses in servicing practically all types of equipment.

From the company standpoint, the question is largely one of economics although not necessarily solely from the dollar cost of a given job.

Then there is the human factor which cannot be overlooked and which is often referred to as "empire building". Relative importance and salary is often measured by the number of employees in a department. One may well ask "Why send work out and cut down the size and the importance of the maintenance department?" This question is all the more logical considering the fact that maintenance expenses cannot be predicted with any degree of accuracy, cost standards are difficult to establish and a stand on either side of the question can often be justified.

The crux of the plant engineer's personal problem, with contract maintenance or any other outside work, is however, "Will I investigate the matter myself and be able to justify my decision when necessary, or, will I sit tight till some one sells top management on the idea and then have it thrust down my throat?"

Perhaps no general conclusions can be reached. The subject, however, has a very fundamental bearing on the plant engineer's position in industry and warrants thought, attention and a thorough airing of views. Following are abstracts of discussion by IPE* members.

These Questions by John M. Mitchell Started the Ball Rolling —Straight Down the Alley

TOO FREQUENTLY the maintenance department is treated as a necessary evil in industry, a poor relative unworthy of real co-operation, or, a remittance man whose cost is steadily increasing due to up-to-the-minute service needs of this mechanical age.

It used to be sufficient to have a few millwrights about the place, assisted occasionally by the operators. Now, technicians, experts in their own field, must be employed on maintenance.

Larger firms may be able to meet these mounting expenses especially where the plant engineer is accorded reasonable authority and status. He can often suggest co-operation between departments, considerably reduce expense, and, iron out difficulties. But it is the smaller concerns which may end up in difficulty by striving to keep up with these new requirements necessary to maintain output yet not be in a position to incur crippling overhead charges.

How can the small firm keep pace with the large and obtain the benefit of services it can ill afford? The remedy may be to put the maintenance and services, wholly or in part, out to a servicing contractor. Is this desirable? Would it meet a need, economically and acceptably?

For the Affirmative, W. V. Tipping Says It's the PE's Salvation but Broadens the Scope

DEFINITELY maintenance by contract is desirable, in fact, we have been doing this type of work not only for small concerns but for very large manufacturers. No one plant engineer can attempt to undertake satisfactorily all the different tasks which are placed upon his shoulders. The time has come when a firm of consulting plant engineers with a staff of specialists must be called in to help the hard-pressed resident engineer.

A very simple example is that of plant removal and installation. The plant engineer is called upon to move all the existing machines into a new factory, but production must not be broken. This can be quite a headache to the plant engineer who may never have tackled such a project.

Now, if an experienced man on removal and installation is called in, things are different. This man spends his time doing this work and is therefore fully conversant with the best methods. The resident plant engineer is free to carry on with his normal work.

Once a plant engineer has subcontracted work he does not hesitate to call upon outside services again. Present day management does not expect the plant engineer to be an expert in every branch of his profession. He must have a good general knowledge of all these branches, but, when things are the least out of the ordinary it should be made a general practice to call on outside engineers.

*The INCORPORATED PLANT ENGINEERS, an organization of plant engineers formed in England in 1946 and which now has a dozen branches in the British Isles with one being formed in India. Headquarters of the association and the secretary's name and address is: Hadleigh S. Seaborne, 48 Drury Lane, Solihull, Birmingham, England.

** See Heat Exchanger Costs, Selection and Maintenance, by A. Levine, PLANT ENGINEERING, April 1949, page 28.

For the Negative E. Wilson Says any Self Respecting PE can Handle the Job

No doubt management of a small factory without a maintenance staff or equipment might well call for outside assistance. However, I do not feel a firm of any size or repute should contract maintenance, and, personally take a poor view of any plant engineer who permits this to take place.

It is true that the maintenance staff are the slaves of production at everyone's beck and call. With a loyal and efficient team, a small amount of equipment and pre-planning, however any self-respecting plant engineer should have no need for outside assistance. Mr. Tipping states that "the plant engineer may never have tackled this problem", but surely no plant engineer should be without this basic experience.

In the case of transferring whole departments to new sites there should be little difficulty with adequate pre-planning. Normally, the plant engineer is given fair notice of a move of this sort and can make arrangements accordingly so as to interfere with production as little as possible.

Although present-day managements do not expect the plant engineer to be experienced in every branch of his profession, they do expect him to be able to obtain necessary information when required.

In Rebuttal, Jas. G. Youll Speaks From Experience on Both Sides —Headaches and Purse Strings

As a former plant engineer, I know only too well the problems confronting the engineer especially those whose duties also cover the canteen or kitchen. Some time ago as engineer to a large concern, I was called upon to design service equipment for the dining room catering for 3000 at one sitting.

This presented no difficulties, but, the next request was to produce the equipment by hand with the assistance of a couple of laborers. Materials for the job were to be taken from a scrap metal dump on the site — no new material and no machine tools. I know of several engineers who have met with similar problems, but luckily for them, not quite to the same extent.

Now I represent a firm of catering equipment specialists. In this capacity I've heard managements say that they employ their own engineer and sing his praises. However, the engineer complains of, and details, problems similar to the ones I used to have. Unquestionably, the consultant or outside engineer does meet a real need. In my opinion, therefore, the pertinent question is "Where does the specialist finish and the engineer commence?" or vice versa.

But, J. W. Nash Disagrees Because Headaches Are the PE's Business.

By his suggestions Mr. Tipping conjures a plant engineer waving a flag of distress and calling for a consultant to come and do his work and leave him "free to carry on with his normal work." I cannot imagine what the plant engineer's normal work would be after the consultant had taken over.

For certain jobs requiring special gear, for instance, boiler setting, economizer renewals and cylinder reboring, I agree that specialists should be called in but only under the jurisdiction of the plant engineer.

It has been advocated that plant engineers should be key-men on the Board of Directors. To attain this status the plant engineer must be capable of dealing with all matters pertaining to plant maintenance, alterations and extensions. In fact, should be one jump ahead of the managing director.

To Mr. Tipping's statement "Present day management does not expect the plant engineer to be an expert in every branch of his profession", I would reply that it is up to the plant engineer to prove that he is an expert, in relation to every phase of the plant he is responsible for. Mr. Tipping detracts from the status of plant engineers when he says that "removing machines into a new factory would be quite a headache to a plant engineer".

Firms or works which only have a managing director, and no plant engineer, of course will have to go to a firm of consultant engineers. I venture to suggest, however, that it would be more economical and satisfactory to employ a qualified plant engineer and do the maintenance work themselves.

F. S. Gastrell Sums Up—All Have a Place but the PE Carries the Ball—and He Can Do It Too

There must be many plant engineers who do not agree with all the points Mr. Tipping puts forward. He says that no plant engineer can attempt all the different tasks which are placed on his shoulders.

From this I take it that he is not a plant engineer in the sense that he is responsible for the maintenance of every sort and size of plant with a management that demands, and receives, instant service. Otherwise, he would be conversant with the fact that the plant engineer must and does undertake all jobs at any time, day or night, or, should it be day AND night?

In the matter of plant removals, this may perhaps be viewed from different angles. It is a fact that management will permit no break in production during a removal. It is also a fact that if the plant engineer is experienced in such work, and I am of the opinion that most inside plant engineers are, he can organize the work so that no break does occur.

It should be stressed that the plant engineer must have a loyal and skilled, but not necessarily large, staff behind him. Otherwise he will be unable to cope with all the extra work which falls to his lot beyond that which may be termed strictly maintenance. Should the staff be inadequate, a contractor's assistance could be called for, but not necessarily every time.

Probably no plant engineer will agree with the statement that "when things are the least out of the ordinary the consulting engineer should be called in". From my experience over 30 years, this would mean that the consultant was on the permanent staff and never off the premises.

In the whole scheme of industry there are places for all three engineers: plant, consultant, and contracting, but, to put forward the view that the plant man must always be referring to his two other colleagues is totally incorrect.

WHAT IS YOUR OPINION ON THIS QUESTION?

Growth of specialized maintenance service organizations and equipment manufacturers service departments indicates that maintenance by contract does have a place in the plant engineer's activities. The question is where, when, and to what extent?

What is your opinion? Confine the discussion to maintenance work, that is, repair, reconditioning and routine maintenance (inspection, cleaning, lubrication and minor adjustments) of equipment and buildings. Assume: 1, The plant engineer is capable and the work will be done under his supervision in either case; 2, that competent outside service is available; and 3, it is desirable in some cases.

Where? What are the advantages and disadvantages? How is this influenced by: the size of the plant? By company policy? By company accounting practice and in applying overhead or burden rate to maintenance labor? Does it detract from the plant engineer's importance?

To what extent do you use it now? To what type of work or equipment is it most applicable: Heat exchangers? Instruments and controls? Electronic equipment? Electric motors and control? Refrigeration and air conditioning? Elevators? Automotive Equipment? Landscaping? What part of the work would you farm out and what part retain for your own crew?

If you wish, your name and company connection will be withheld!

Maintenance and Operation

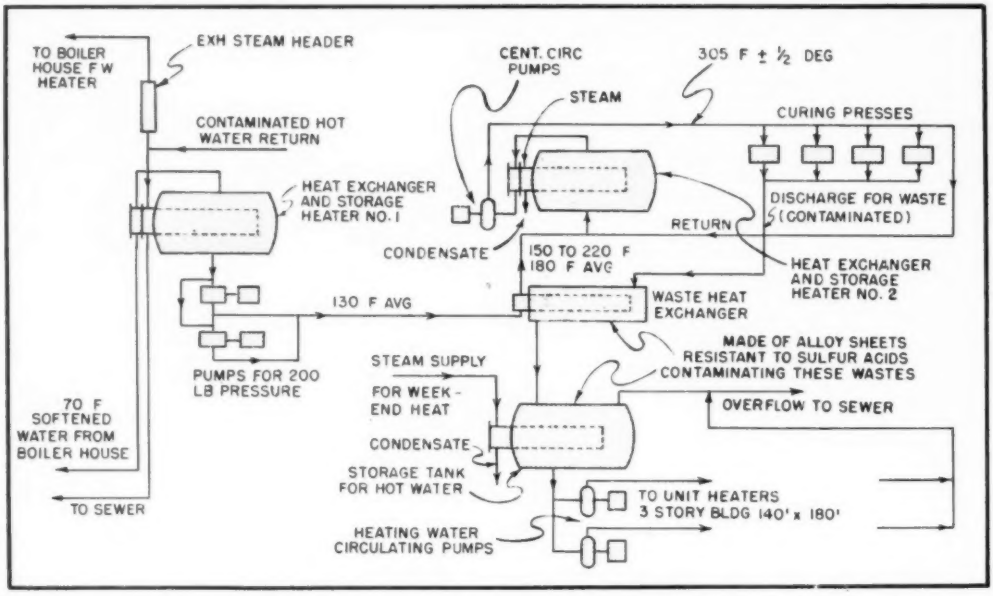
Exchanger Practice at Lee

(Continued from page 4)

The final temperature of the water is attained by another heat exchanger and a storage heater where the temperature is maintained within 1 deg before being passed on to the tire mold; this final temperature is attained by using steam at 125 lb per square inch.

Incidentally, to conserve the residual heat in the steam and the water discharged from the second stage mentioned above, the discharge is admitted to a storage heater during the heating season. This is then pumped through unit heaters in a three story building which is approximately 140 ft by 180 ft in size. During the summer this heat is disposed to the sewer.

The first and second stage heaters repaid their installation costs in the relatively short periods of five to six months. These are items the plant engineer can not afford to overlook. At the same time their maintenance cost has been relatively low because foresight was exercised to guard against abnormal difficulty in servicing this equipment. A heat exchanger properly applied may be used for the raising of temperatures of liquids as well as for the removal of excess heat from waste and by this means can be made to pay for themselves in short periods.


TO BOILER HOUSE F W HEATER
EXH STEAM HEADER
CENT. CIRC PUMPS
305 F ± ½ DEG
STEAM
CURING PRESSES
CONTAMINATED HOT WATER RETURN
HEAT EXCHANGER AND STORAGE HEATER NO. 1
DISCHARGE FOR WASTE (CONTAMINATED)
RETURN
CONDENSATE
150 TO 220 F 180 F AVG
HEAT EXCHANGER AND STORAGE HEATER NO. 2
130 F AVG
WASTE HEAT EXCHANGER
MADE OF ALLOY SHEETS RESISTANT TO SULFUR ACIDS CONTAMINATING THESE WASTES
STEAM SUPPLY FOR WEEK-END HEAT
PUMPS FOR 200 LB PRESSURE
70 F SOFTENED WATER FROM BOILER HOUSE
OVERFLOW TO SEWER
CONDENSATE
STORAGE TANK FOR HOT WATER
TO UNIT HEATERS 3 STORY BLDG 140' x 180'
TO SEWER
HEATING WATER CIRCULATING PUMPS

Schematic system of heat exchanger hook-ups for curing water in the tire plant of Lee Rubber & Tire Corp.

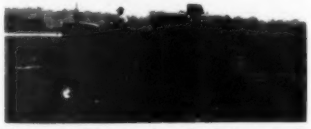
Waste Oil and Parking Lots

Contributed by William W. Wicks

WE HAD AN awful lot of waste oil, here at the Louisville Works of International Harvester, which heretofore had created nothing useful but did stir up a lot of disposal problems. Another headache was the parking lot for employees' automobiles and the lot where tractors were stored prior to shipment. Both these lots were unusually dusty and hard to keep in good shape.

It was decided that the waste oil would make a good dust settler if some way could be found to get it spread on the surface of the two lots. So the Plant Engineering department was called upon and they built a frame on wheels, mounted an old oil tank on this base and attached a large perforated pipe with a lever to control the flow of oil. The locomotion was supplied with one of our Farmall Cubs.

The oil is a soluble cutting oil, not fuel oil. It is mixed with about 80 parts of water for the spraying operation which is done once a week. About 1 gal of this waste-oil and water emulsion is spread by the tank for every square yard.



This sprinkler tank solved two problems for the Louisville Works of International Harvester Company

Checking Engine Flywheel for Trueness

Contributed by Geo. Pheil, Twin Disc Clutch Co.

THE METHOD OF checking trueness of both flywheel and flywheel housings was originated in the course of my work and is a decided asset to anyone engaged in engine installation, service or maintenance. Step-by-step, the operation is as follows:

1. Clean the flywheel and its housing thoroughly.

2. Bolt the thousandths indicator or gage to the flywheel so it is perpendicular to the housing face and

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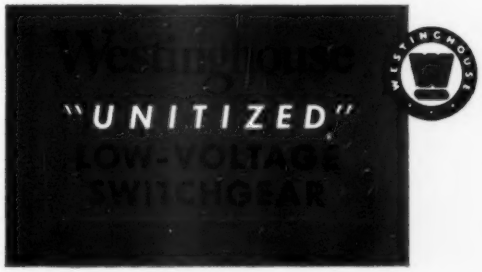

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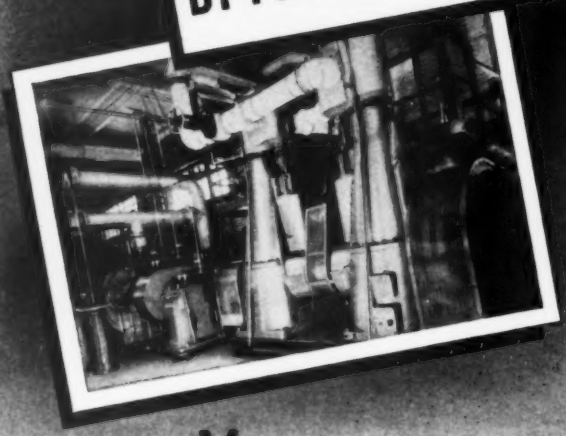

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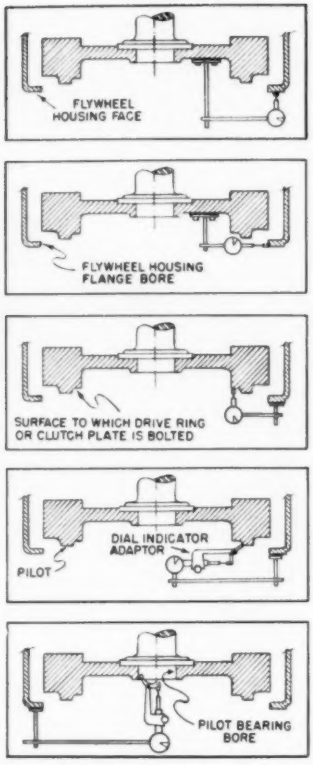

FLYWHEEL HOUSING FACE
FLYWHEEL HOUSING FLANGE BORE
SURFACE TO WHICH DRIVE RING OR CLUTCH PLATE IS BOLTED
DIAL INDICATOR ADAPTOR
PILOT
PILOT BEARING BORE

Various positions of indicators as outlined in the article are shown in the sketch

the indicator stem is riding on the flywheel housing face. See Fig. 1.

3. The maximum deviation of the face of the flywheel housing flange, from its true position when the flywheel is rotated on its axis, should be 0.005 in.

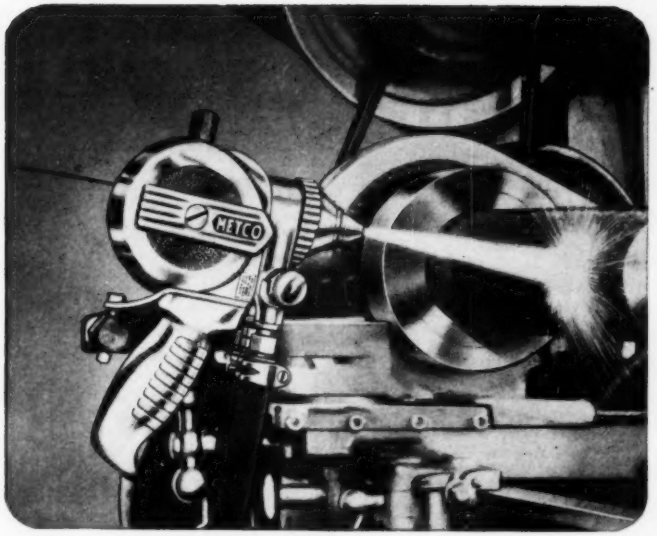
4. The next step is to readjust the indicator so that the stem will ride on the face of the flywheel housing flange as shown in Fig. 2. The maximum eccentricity of the bore of the flywheel housing shall be 0.005 in.

5. Then, remove the indicator bracket from the flywheel and bolt the indicator to the flywheel housing and check flywheel runout, as shown in Fig. 3.

6. The maximum variation of the surface to which the driving ring or clutch plate is bolted shall be 0.0025 in. (Total indicator runout—0.005 in.)

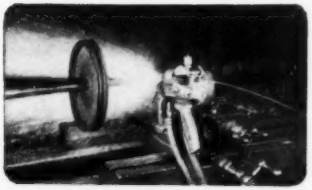
7. The maximum eccentricity for the pilot in the flywheel which pilots the driving ring or clutch plate shall be 0.0025 in. (Total indicator runout—0.005 in.) See Fig. 4.

8. With the indicator bolted to the flywheel housing, as shown in Fig. 5, check the eccentricity of the pilot bearing bore in the flywheel. The maximum eccentricity for the bore



now a really low-cost metallizing installation...

with the *new* Metco L-Gun



Metallizing damaged journals on turbine shaft

Building up worn brake-drum

Metallizing protective coating on steel plate

New, low, compressed-air requirements . . . only 10 cfm at 40 to 60 psi, already available in many shops, or supplied by inexpensive 3 hp compressor . . . bring metallizing within reach of the small user.

Here's a chance for the smaller maintenance shop to get into profitable metallizing operations like these:

- Save up to 90% of replacement costs on machine repair jobs,
- Do your own hard-facing,
- Apply long-wearing corrosion-resistant coatings to exterior plant structures, tanks and other equipment.

Sprays 23 Different Metallizing Wires—With the new L-Gun you can spray .10, .25, .80 carbon steels, stainless; babbitts, brass, bronze; nickel, aluminum, tin, zinc; special hard-facing materials such as Metco-Weld H, and the new self-bonding spraywire, Sprabond.

It's Versatile—Use the L-Gun machine-mounted or hand-held—it weighs only 4 lb. 2 oz. Do all kinds of metallizing work—shaft and bore build-up with harder, longer wearing metals; build up worn pump plungers, crankshafts, motor shafts; apply corrosion-resistant coatings. There are hundreds of different jobs that are "naturals" for metallizing.*

Same High Quality as Other Metco Guns—The low air requirements of the new L-Gun have been achieved without any sacrifice in Metco quality. It embodies new developments in turbine and nozzle construction—is built, like all Metco guns, for rugged, dependable service.

A Real Opportunity for the Smaller Shop—Thousands of large, well-known companies have been metallizing users for many years, not only in maintenance but in production applications on original equipment. Now, with the development of the new L-Gun, and a low cost installation, metallizing is within the reach of even the smallest plant. (We'll be glad to send you the names of some Metco users—large and small.)

Free Bulletin or Shop Demonstration—Send off the coupon for the detailed information Bulletin 55 gives you. Or, better still, ask for a demonstration in your own shop by a Metco Field Engineer. He'll be glad to show you how the new Metco L-Gun works on some job of your own. No obligation, of course.

***Where NOT To Use Metallizing**—Metallizing is a practical, low-cost method of performing literally hundreds of maintenance and production operations. Briefly, it can be used wherever metal build-up is desired—*except* 3 types of parts; those subject to *impact* (such as dies, punches); *point stress* (ball bearings); or *elongation* (gear teeth, threads). Use it anywhere else, but whenever in doubt just drop us a line.

METALLIZING ENGINEERING CO., INC.
38-13 30TH STREET — LONG ISLAND CITY 1, N. Y.

R. J. McWaters
Metallizing Engineering Co., Inc.
38-13 30th St., Long Island City 1, New York

☐ Please send me L-Gun Bulletin 55:
☐ Arrange a free demonstration in my shop:

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is based on these

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SPHERICAL CONTACT

The two seats in each Dart Union are spherical-ground to form a *true ball joint* that's drop-tight and leak-proof.

PROPER ALLOYS

Both seats are made of bronze—which means they're *non-corroding* . . . longer lasting.

TROUBLE-FREE DESIGN

Darts close without damage, jamming, or excessive wrenching. Body and nut are made of high-test, air-refined malleable iron . . . practically indestructible.

For these and other Dart advantages, order *today* from your supplier.

DART UNIONS

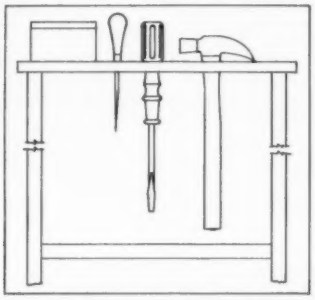
E. M. DART MANUFACTURING CO.
PROVIDENCE 5, RHODE ISLAND

in the flywheel for the pilot bearing shall be 0.0015 in. (Total indicator runout—0.003 in.)

Ladder Changes Can Save Time

Contributed by W. F. S., Newark, N. J.

As SHOWN in the accompanying sketch a step ladder can be considerably improved by fitting the top with a holding slot or with several holes or devices for safely holding the tools. It is also a good plan to



A rack of this type makes operation at ladder-top safer for passers-by and easier for the mechanic

attach to the top a box, with partitions which extend all the way to the cover, (which should be tight-fitting) for carrying small parts such as nails and screws. Climbing up and down a ladder to get a forgotten or needed tool is tiring, time-consuming and costly.

Locating Faulty Joints in Power Lines

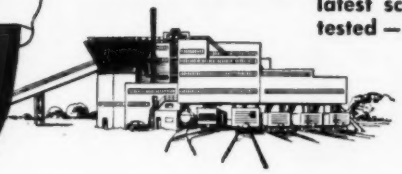
A NOVEL INFRA-RED DETECTOR, designed to locate faulty joints in overhead power line conductors, is described in a report now available from the Office of Technical Services, Department of Commerce.

Designed in the laboratories of the National Research Council of Canada, the instrument is tripod-mounted, and used like a surveyor's transit. It is optically pointed to the power-line and electrically records temperature differences between the conductor and the joint by means of thermal radiation focussed on a bolometer by a parabolic reflector.

The most satisfactory design employs a thermistor-type bolometer in an a-c bridge circuit, according to the report. Signals from this bridge, amplified by a conventional a-c amplifier with a phase sensitive rectifier output, operate a fifty microampere zero-center meter, which serves as an indicator that can be viewed simultaneously with the sighting device, so that the operator can see the source of unusual heat.

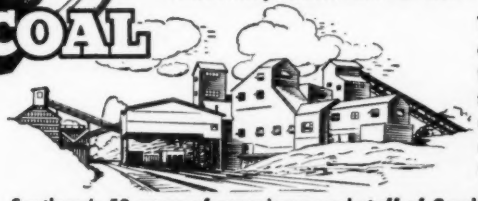
First Choice of Industry
because of Improved Preparation!

OLD ABE Coal . . . from one of America's newest and largest producing mines . . . is a superb stoker and industrial coal that is performance-proved for its clean, free-burning qualities. Expertly prepared by the most modern methods known to the industry, in a new preparation plant fully equipped with the latest scientific machinery. Laboratory tested — thoroughly washed — sized to your needs — oil treated (if desired).



VOGUE Coal is another of Southern's ultra-modern quality coals, that is specially processed in a great, new streamlined preparation plant. It's low in ash—free-burning—and high in BTU value. Washed, oil treated (if desired) and sized to a maximum degree of uniformity for ideal stoker and industrial use.

SKIBO Coal is the latest and most popular coal ever marketed by the producer during 50 years of successful operation. It meets industry's demands for quality and unvarying efficiency. Skilled mining engineers and laboratory technicians assure uniform production day after day. Thoroughly cleaned in one of the most modern washers obtainable — oil treated (if desired), uniformily sized. Low in ash — high in BTU value.



These three great premium industrial coals from Western Kentucky are ready for immediate shipment. Tremendous production and extensive reserves assure dependable delivery for years to come.

Southern's 53 years of experience and staff of Combustion Engineers are ready to help you solve your particular boiler room problems. Telephone, write or wire and a Southern representative will call.

SPONSORING MEMBER COAL HEATING SERVICE NATIONAL COAL ASSOCIATION

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AVS-2

Southern Coal Company, Inc.

Atlanta Birmingham Charlotte Chicago Knoxville
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Cut Pulling-Time Costs
with Snap-on's
Powerful THREE-JAW PULLER

This mechanic is removing the chain-driven main drive gear on an automatic screw machine. Note how the jaws spread to grip the wide chain-retaining flange. The circular locking plate tightens the jaws so that the puller holds its position without being held by the mechanic, leaving both his hands free for a fast, easy and safe pulling.

Efficient jaw capacity is 8½" on outside holds with a minimum of 2½" diameter opening for inside pulls. Different sets are available for conversion to a screw, slide hammer or combination type puller. Snap-on has 40 direct factory branches in key industrial centers. Write for data sheet and name of nearest branch.

SNAP-ON TOOLS CORPORATION
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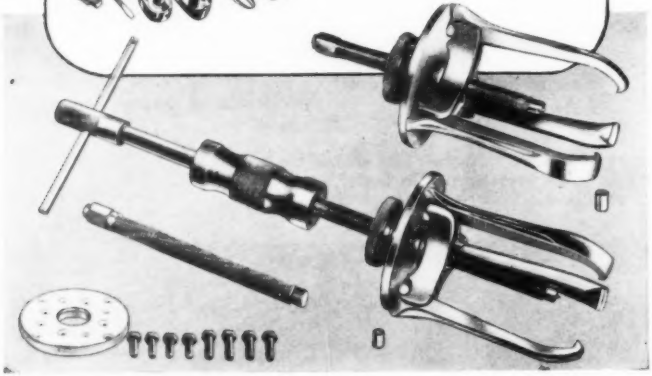


Bulletins on Current Plant Problems

ELECTRICAL

101 Electrical Equipment — Manufacturer's line of electric products is presented in this 70-pp condensed catalog. It covers safety switches, range panels, lighting panels, circuit breaker panels, switchboards, wire and fuse grips, and bus duct. Special features of all equipment are described, and regular listings include illustrations, specifications, dimensional and installation data and current prices. Bull Dog Electric Products Co.

102 Instrument Transformers — This 32-pp illustrated bulletin, 61B7168, presents engineering data on various types of the company's transformers—indoor and outdoor current type, indoor and outdoor potential transformers and outdoor metering outfits. Complete information on each type, including prices. Allis-Chalmers Mfg. Co.

103 Service Entrance Equipment — This new Folder TEC 311A describes a streamlined fuse puller switch to be used as residential type panels for main, range and lighting circuit protection. The inside spread of the 4-pp folder contains photographs and descriptions of the important features plus illustrations of the flush type fuse puller and the surface type. Catalog listings of the various circuit combinations are given. Trumbull Elec. Mfg. Co.

104 Battery Chargers — Bulletin B 234 offers 4-pp of data about single-circuit motor-generator battery-charging equipment. Clearly illustrated with photos, it explains how anyone can use these chargers, described as automatic in operation and requiring a minimum of maintenance. Gives capacities, dimensions and charging time for five lead-acid chargers and four Edison chargers. The Electric Products Co.

105 Selenium Rectifiers—This 28-pp bulletin presents the company's line of selenium rectifiers for electronic and electrical applications. It is devoted entirely to an exposition of the rectifiers' characteristics, applications and design factors. The fore part of the booklet contains complete descriptive material including rectifier circuits, while the back portion consists of tables. Vickers Electric Div., Vickers Inc.

106 Synchronous Motors — High speed synchronous motors are described in this recently-issued 4-pp bulletin, PB 5600-1. The bulletin is packed with descriptive matter and photographs explaining features of the motors' rotor and stator. Mechanical modifications also are illustrated. Elliott Co.

107 Plug-In Strip—Catalog CF 2 and 3, 12-pp, describes and illustrates the company's line of Plug-In Strip. Methods of installation and advantages in its use are outlined by means of text and drawings and the component parts are illustrated. One section on "Installation Features" is particularly well illustrated with line drawings. National Electric Products Corp.

108 Instrument Transformers—A line of "butyl molded" current transformers is introduced in this 8-pp illustrated bulletin, GEA-5274. It explains the butyl molding technique involved in their production and why it has been adopted. It discusses the 5000-v indoor model which is the first of the line, describing in detail and illustrating by photos, the primary and secondary coils, interleaved core and heavy steel base. Includes ratings and graphs of transformer accuracy up to 150 per cent of rated current. Apparatus Dept., General Electric Co.

109 Switchgear Bulletin — Construction features of metal-enclosed low-voltage switchgear and drawout air circuit breakers are described in 8-pp Bulletin 18B6376A. It illustrates the self-supporting structure of the switchgear's framework, its pantograph construction, which provides an arrangement for withdrawing circuit breaker units, and other features. A chart supplies dimension and typical panel data on the switchgear which is available in current

D-C Power Costs Cut 20% Yearly!

Mr. R. H. Hill, chief electrical engineer at U. S. Arsenal, Watervliet, N. Y., makes a periodical inspection of G-E mercury-arc rectifier.

G-E rectifiers cut Arsenal's yearly maintenance and operating costs $3500

Mr. R. H. Hill, at the U. S. Government Arsenal, Watervliet, N. Y. is just one of the many forward-looking plant engineers who is cutting his plant's power bill with the new, modern way to get d-c power—by installing mercury-arc power rectifiers.

You can install these units, and then practically forget them. This means big savings in both maintenance and operating costs.

Mr. Hill, for example, says that installing a G-E 400-kw rectifier at the arsenal in 1943 reduced maintenance expense $500 a year. At the same time he reduced operating expense about $3000 a year, because he was able to transfer to other work the operators formerly needed. Total savings of $3500 represent a 20% cut in yearly d-c power costs.

TO CUT YOUR POWER COSTS

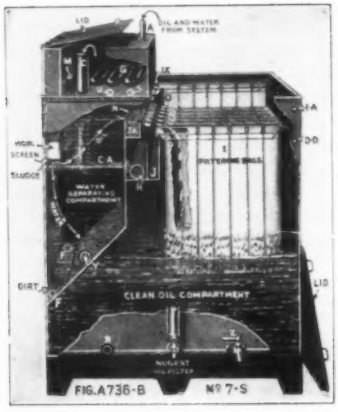
Find out today how you can cut your power bills by putting G-E mercury-arc power rectifiers to work in your plant. Call or write your nearest G-E sales office for information. *Apparatus Department, General Electric Company, Schenectady, N. Y.*

G-E Mercury-arc Rectifiers Mean Low-cost D-c Power

GENERAL ELECTRIC

Maintenance Down . . . Savings Up . . .

When you use NUGENT GRAVITY OIL FILTERS *for turbine systems*



Nugent Gravity Oil Filters are the economical method of handling filtering problems in large stationary installations. Experience shows that average oil savings are in excess of 95%. And by assuring a continuous supply of CLEAN oil, maintenance is reduced and equipment life extended substantially. For protection against corrosion Nugent Filters neutralize acidity and maintain a safe value. For economy's sake you can't afford to be without a Nugent Oil Filter.

Nugent Gravity Oil Filters may be operated continuously since each of the multiple filtering units can be removed independently for cleaning. And for further convenience an alarm is given automatically when cleaning is necessary. Write for full details today.

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450 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

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ratings of 15 to 5000 amp, interrupting ratings to 100,000 amp, 250 v d-c and 600 v a-c. Bulletin points out that this switchgear can also be installed out-of-doors in which case it is enclosed in weatherproof housings. Allis-Chalmers Mfg. Co.

110 Control Switch—Data Sheet 54, 2 pp, describes and illustrates a manual control switch with large button type of actuator, for controlling electrical circuits on power presses, stamping machines, molding machines, welders, and other equipment where light touch actuation, dependability and safety are of special importance. Includes characteristics, electrical ratings, a description of construction features and price. Micro Switch.

INSTRUMENTS AND CONTROLS

111 Megger Selection Aid—A time saving selection chart and many practical hints that simplify the correct choice of an insulation resistance tester are included in Bulletin 21-05, 8 pp. Ten different types of Megger instruments covering ranges from 0.01 ohm to 10,000 megohms and including hand-operated-motor-driven, rectifier operated, combination hand-operated and rectifier operated, and recording sets are discussed. Their applications in all major industries are described and many of these applications are illustrated by photographs. James G. Biddle Co.

112 Rotameter Bulletin—Electronic, electric and pneumatic recording and controlling rotameters are covered in Bulletin 18-RC, 12 pp. Numerous photographs, cutaway views, sectional drawings, and functional diagrams accompany the explanation of the construction, operation and application of these instruments. Schutte and Koerting Co.

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for requesting additional information on advertised products, new bulletins and new equipment. When writing or sending a coupon DIRECT to an advertiser please be sure to mention PLANT ENGINEERING. If you prefer to send your request through us give the item number, or the page number of an advertisement and advertiser's name. If you don't see what you want, ask for it.

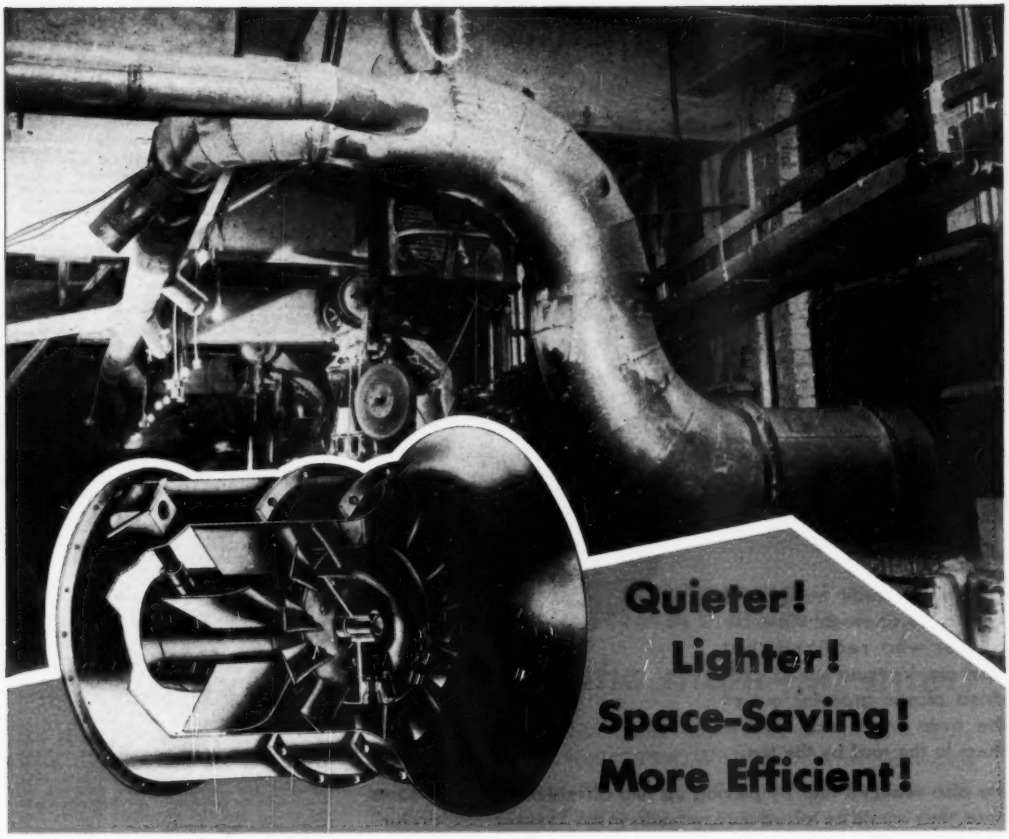
113 Instrument Handbook—"Modern pH and Chlorine Control" is a 100-pp catalog containing a great deal of valuable information in addition to covering manufacturer's line of instruments and accessories. It explains the meaning of pH control, the electrometric and colorimetric methods of determining pH, and gives values of common acids, bases and foods, and maximum buffer capacities of buffer systems. It also discusses in detail the applications of pH and chlorine control in air conditioning, water treatment, boiler water and many other industrial applications, recommending instruments and solutions. Instruments illustrated, their functions described, sizes and prices given. W. A. Taylor & Co.

114 Recording Viscometer—Bulletin V-1000A describing the company's recording viscometer has been issued. The viscometer was specially designed for general use as process controls in industry and is available in an explosion-proof type for hazardous locations. The excellent illustrations include two charts which show typical applications of the instrument plus dimensioned drawings. Norcross Corp.

115 Instrumentation—A report on the entire instrumentation of the Bureau of Mines coal-to-oil demonstration plant at Louisiana, Mo., is contained in a recently-issued 20-pp paper-bound booklet. The entire project makes use of more than 500 industrial instruments, plus 200 related types. The booklet shows and tells how and why they were used and points out how this was one of the most difficult of instrumentation jobs. Minneapolis-Honeywell Regulator Co.

MATERIALS HANDLING

116 Car Shakers—Construction features, installation data and specifications on a



JOY AXIVANE* FANS

(SERIES 1000)

Write for Bulletin, or

Consult a Joy Engineer

The quieter operation, lighter, more compact design, lower power consumption and unmatched efficiency of JOY Axivane Fans are *real* advantages! What's more, their vaneaxial design and in-line construction permit mounting right in the air duct, making installation simple and saving greatly on time and cost. These features—plus the extreme flexibility of operating range made possible by adjustable blades, *exclusive* with JOY Fans—mean better, more dependable and lower-cost ventilation, no matter what your conditions are.

● Let JOY Axivane Fan specialists work with you for best results on your ventilation jobs.

*Reg. U. S. Pat. Off.

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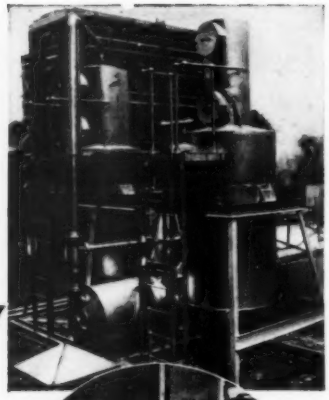
Spencer Vacuum Equipment on roof of chemical plant



"*Processed by*

SPENCER VACUUM"

That might well be the expression applied to the entire operation of blending, mixing, sorting and packaging in this large section of a well known chemical plant.

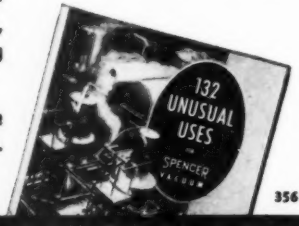
Emptying Trays

The major credit however is due to the Chemical Plant Engineer who realized that Spencer Vacuum could pick dried plastic granules out of the oven trays and elevate them to the roof by the ton.

He also realized that by picking up two different lots at the same time, they would be mixed automatically in the Spencer "Separator" on the roof. Then gravity did the rest, through vibrating screens and other devices, and then into bags in the shipping room on the first floor.

And this is only one of the "Unusual Uses" illustrated and described in the new 24 page Spencer Bulletin. It shows how industrial engineers apply vacuum to remove liquids, gases, powders, metal scraps, and hot materials. It gives diagrams showing applications such as unloading freight cars, and bottling milk. It illustrates how the machinery designing engineer has improved equipment for making hats, pills, textiles, and for calculating machines.

Ask for the bulletin and see where and how Spencer fits in your plant.



356-C

SPENCER HARTFORD VACUUM CLEANING

THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

new car shaker are presented in Bulletin 07B7221. Containing 6 pp, the bulletin lists typical applications, presents excellent illustrations and complete specifications and other data. Allis-Chalmers Mfg. Co.

117 Haulage Locomotive—A high-speed, four-motor mine haulage locomotive is described in 4 pp bulletin GEA-4774A. Excellent drawings and photographs illustrate the locomotive and important facts and figures are outlined. Construction features are detailed. Locomotive and Car Equipment Divs., General Electric Co.

118 Conveyor Team—An arched delivery hopper car unloader and an open trough belt conveyor, both adaptable for use with all abrasive or non-abrasive materials and capable of handling 60 t per hour, are covered in 4-pp Form A35. Photos of complete assemblies and parts and dimensional sketches illustrate an explanation of their construction and operation. Also describes a lighter conveyor and horizontal hopper car unloader. Baughman Mfg. Co., Inc.

119 Hydro Bins—Dehydrating equipment for handling coke, ashes and similar material is described and illustrated by photographs in Catalog 1240, 8 pp. Photos show many of these bins now in industrial service, including several of the sectional plate cast iron type. Two pp are devoted to a discussion of company's water collecting anti-freeze gate. Allen-Sherman-Hoff Co.

120 Screw Conveyor—Two-pp Form A-84 describes a high-speed, direct-feed, bin-to-stoker screw conveyor that comes ready to set up. Illustrations show this conveyor in use and detail of its principal parts. Stresses economy of this conveyor in handling coal and includes specifications. Baughman Mfg. Co., Inc.

121 Porcelain Enamel Applications—This 8-pp pocket-size folder explains why porcelain enameled materials handling equipment permits faster, smoother and cleaner movement, is economical, and gives longer service. Contains many pictures of such equipment—conveyors, chutes, idler rollers—in use. The Erie Enameling Co.

122 Storage Bins—Catalog 202, 4 pp, features storage bin sections designed so that one section nests into the other deeply enough to provide a substantial unit. Emphasizes the versatility and economy of these bins for stockroom use, pictures them set up for use, and tells some of their applications. Also describes a stacking unit and individual bins. Includes dimensions, specifications and prices. Stackbin Corp.

INSULATION

123 Insulation Bulletin—Insulating materials and preformed insulations for buildings, roofs, pipes, low temperature structures and acoustical purposes are described and illustrated by photograph in Form G-48-6, 8 pp. Gives physical properties, thermal conductivities, available forms and specifications, also installation tips. Sound absorption coefficients are given for acoustical insulations. Also described is an extra fine, light insulation for thermal and acoustical application. Owens-Corning Fiberglas Corp.

124 Pipe Insulation Facts—Here's a 4-pp bulletin on a flexible pipe insulation with self adhesive edges for stopping condensation drip from cold water pipes, insulating refrigeration lines and air ducts and deadening sound. It describes the insulation, tells its advantages, how it is used, where it should be used; why it works. Includes specifications. Mystic Adhesive Products.

125 Insulation Handbook—Available this month to plant engineers having a direct interest in industrial heat insulation is a 96-pp manual on 85 per cent Magnesia insulation, illustrated with line drawings and photographs. Among the subjects covered are: properties of 85 per cent Magnesia, determination of correct thicknesses, application and finishing procedures, and insulation maintenance. The appendix contains a discussion of practical applications of heat transmission theory, definitions of technical terms, 15 tables of data on this insulation, a glossary of trade terms and list of trade names of the insulating material and accessory products. The Magnesia Insulation Manufacturers Association.

HOSE

126 Water Hose—Manufacturers line of water hose for industrial service is pictured and described in detail in Catalog Section 4800, 4 pp. It covers hose for pressures up to 250 psi and for use with hot or cold water. Provides specifications, coupling information; gives recommended uses. The B. F. Goodrich Co.

127 Refrigerant Service Hose—An illustrated bulletin describing refrigeration charging hose of a new type of construction has just been issued. The hose utilizes a neoprene packed corrugated steel core for gas-tight strength and flexibility. The bulletin shows its construction in detail. Chicago Metal Hose Corp.

128 Hose Clamps—Bulletin 125 describes a line of hose clamps designed to fit every type and size of industrial hose. Construction features of the clamps are thoroughly outlined and tables of sizes, materials are presented. Hose Accessories Co.

129 Acid Hose—Catalog Section 3440, 4 pp, on acid hose for discharge, suction and pinch-valve service, recommends the uses to which this hose should be put—the carrying of inorganic acids except those which are also strong oxidizing agents. It features a table recommending concentrations, temperatures and pressures of the various acids to give longest service life to the hose. Advantages and specifications of the product are given. Illustrated with photos showing construction of hose and hose joint. The B. F. Goodrich Co.

VALVES

130 Pressure-Seal Valves — Illustrated Catalog 12-H, just released, contains 12 pp of excellent information on cast steel valve designs with pressure-seal bonnets for high pressure and high temperature service. It presents all details of design, material specifications, pressure temperature ratings and charts for correlation of valve size and pressure drop. Covers globe and angle stop, non-return, and check valves in sizes 6 in. through 14 in. for 900, 1500, 2500 lb pressure. Edward Valves, Inc.

131 Control Valves—A complete line of control valves for steam, air, liquid or gas service from 0 to 250 psi, are described in this catalog. One feature of the bulletin is a set of three valve capacity alinement charts—for steam, liquids, and gases. The Sinclair-Collins Valve Co.

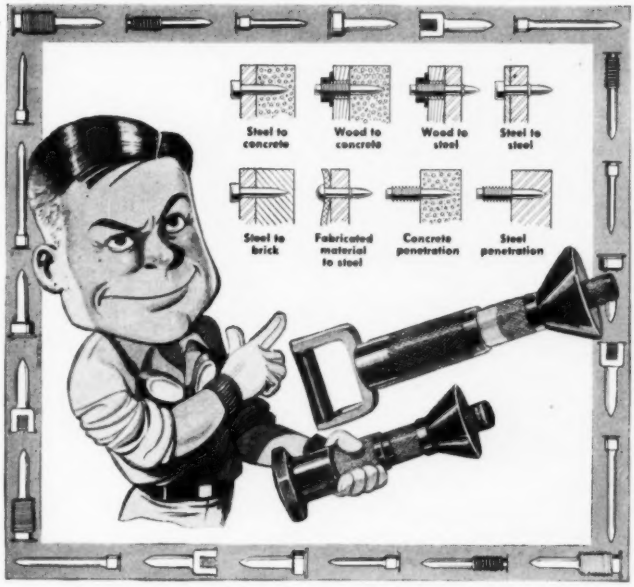
132 Solenoid Air Valves—Folder S introduces a line of improved single and double solenoid operated valves for air pressures up to 125 psi, recently placed on the market to supersede manufacturer's previous designs. Illustrated with photos and cutaway views of these valves. Specifications, sizes, prices included. Valvair Corp.

133 Pressure Reducing Valves—Complete information on self-contained, pilot operated, pressure reducing and regulating valves for use with water, air, refrigerating fluids and any non-corrosive oil or gas is furnished in 8-pp Bulletin 966. Illustrations include photos of the valves and cut-away views. Text tells how these valves work and how to establish ideal range; also describes construction features which contribute to operating efficiency. Includes dimensions, specifications, capacity charts for liquids and gases. A. W. Cash Co.

134 Precision Valve Data — Information on manufacturer's precision valves is given in Catalog 251, 16 pp. It describes and illustrates, by photos and dimensional sketches, foot operated valves, hand operated valves, junior valves, speed control valves, solenoid valves, pilot valves and other types. Includes 2 pp of diagrams showing typical circuits employing these valves; lists sizes. Hanna Engineering Works.

BUILDING MAINTENANCE

135 Stopping Masonry Leaks—Preventing leaks in basements, tunnels, reservoirs, pits, foundations and similar locations by use of the manufacturer's cement is outlined in this folder. A description of the



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Fastening jobs like those illustrated are all in a day's work for JOE RAMSETTER. With his light, self-powered RAMSET TOOL, and 63 sizes of pins and studs, he can set up to 50 fasteners per hour, to cut costs and finish the job faster.

No chipping, no drilling, no plugging. No electric or air lines. Prepare the RAMSET TOOL in 30 seconds. Then, place it against the work and RAM! The fastener is set instantly, tightly, easily. We teach any alert, careful workman to "RAMSET", in 30 minutes.

For fastenings in steel, concrete and other hard-to-work materials, RAMSET pays big dividends in time and money. Use the coupon for complete information.

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In Canada—Globe Machine Tools, Batawa, Ontario.

PE-7

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FOR LOW COST MAINTENANCE

Koiled Kords eliminate trailing wires, reduce replacements, minimize accident hazards. They are easy to install, convenient, economical and safer than straight cords for any moving machine or tool. Koiled Kords come in standard lengths of neoprene-jacketed power cords or can be made to specifications.

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DYNAPRENE

Neoprene-Jacketed Flexible Cords

Where straight cords are desirable be sure to get DYNAPRENE Flexible Cords, the best cord that money can buy — yet priced only slightly above ordinary rubber-jacketed cords. The heavy, tough, abrasion-resistant tire-tread neoprene jacket on DYNAPRENE Flexible Cords stands up longer under all operating conditions.

Be sure to specify type SO or SJO for your flexible cord requirements.

See your nearest Graybar Warehouse

Koiled Kords INCORPORATED

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manner of use and photographs are presented. Stonhard Co.

136 Roof Maintenance Handbook—"Solving Roof Problems," 32 pp, discusses both the causes of and remedies for roof problems. Illustrated with photos, diagrams and drawings, it covers the composition of various kinds of roofs, factors entering into roof deterioration and method of diagnosing roof troubles. It tells how to plan roof repairs, describing in detail the repairing of copings, parapets and flashings, area treatments, and localized roof repairs. It also tells when to discard built-up roofs. This informative book also contains a little humor in the form of verses and sketches emphasizing roof pointers to be remembered. The Tremco Mfg. Co.

137 Maintenance Scaffolds—This 12-pp bulletin describes a scaffold designed to meet the many needs of plant engineers, building managers and others who have "off-the-floor" jobs to be done. The front portion of the bulletin describes the various construction features of the unit. The center part shows how the scaffold is used for maintenance and building jobs; the last part tells about models available. Baker-Roos, Inc.

138 Scaffold Bulletin—By means of photographs this 6-pp bulletin shows some of the many industrial uses for portable upright scaffolds and illustrates special features of manufacturer's line. One page of pictures is devoted to showing how quickly and easily these aluminum alloy structures can be erected. Dimensions and weights included. Up-Right Scaffolds.

EXPANSION JOINTS

139 Expansion Joints for Extreme Conditions—Illustrated Bulletin EJ-49 provides 8 pp of valuable engineering and product information for plant engineers dealing with piping where pressure and temperature extremes exist, and where pipeline expansion under working conditions is a prime consideration. It contains data on both "free flexing" and "controlled flexing" corrugated type expansion joints in copper and stainless steel construction. Chicago Metal Hose Corp.

140 Expansion Joint Design Guide—Titled, "A Design Guide to Expansion Joint Selection and Application," this is a 28-pp bulletin written in non-technical language and containing numerous illustrations, charts and tables. It was prepared to simplify the selection and application of expansion joints in piping systems. Contains data on sizes and types necessary to fulfill individual requirements of temperature, pressure and other conditions. Chicago Metal Hose Corp.

HEATERS, HEATING

141 Condensate Drainage Control—An expanded 24-pp bulletin, Publication 3250, on high pressure condensate return systems, has been published. Data on steam flow conditions and heat exchange characteristics make the technical portions of this new book particularly useful to plant engineers who have problems in efficient heat transfer in cooking, heating, drying and pressing operations. The bulletin is well illustrated with colored drawings and photographs and is filled with tabular engineering data. Cochrane Corp.

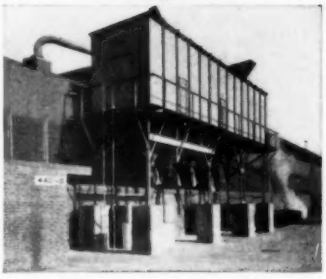
142 Warm Air Heaters—Warm air heating for industrial buildings and the equipment necessary are described in 8-pp Bulletin 10. Complete tables of capacities in Btu output and dimensional and other data are published in connection with each piece of equipment. The bulletin is well illustrated. Lee Engineering Co.

143 Instantaneous Water Heaters—Six-pp Bulletin 70 presents in detail information on instantaneous water heaters including capacity and dimension tables for two-pass, four-pass and six-pass designs. A typical piping hook-up for the installation of these heaters is shown. Additional features include instructions for heater selection, engineering data to determine boiler capacities required and an easily read chart to determine pipe sizes for any steam flow at practical operating pressures. Davis Engineering Corp.

144 Heater Application Booklets—Here are five illustrated booklets (6 to 12 pp

SLY

Pioneers and Leaders in INDUSTRIAL DUST CONTROL



This Filter ventilates Blast Rooms and Cabinets in an aircraft engine overhaul shop. Exhaust fan is located in fan house on end of dust filter.

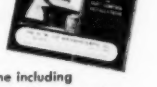
SIMPLE, EFFECTIVE SHAKER MECHANISM KEEPS FILTERS AT TOP EFFICIENCY

Sly Dust Filters collect dust by filtration of the dust-laden air through cloth—*they get all the dust.*

They collect the dust on the *outside* of *flattened* cloth tubes (bags)—visible and easily accessible for inspection and maintenance.

To maintain collecting efficiency, the dust must be periodically shaken from the bags. The effectiveness of the Sly Shaker Mechanism is one of the outstanding advantages of the Sly Dust Filter. It operates year after year with little, if any, maintenance and keeps the collector at top efficiency.

It will pay you to look into the many advantages of Sly Dust Filters. Ask for Bulletin 98.



A complete line including small "Unit" Filters for smaller operations.

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each) covering major industrial uses of tubular, strip and cartridge heaters. They are intended to show how electric heat, properly applied, can help industry provide better equipment designs and improve product quality. The booklets, all emphasizing the "heat where you want it" theme, include: "Heating Pipelines," (GET 1739); "Melting Soft Metals," (GET 1740); "Heating Process Air," (GET 1741); "Heating Liquids," (GET 1742), and "Heating Surfaces," (GET 1743). Each provides detailed application information, including data and formulae for calculating heat requirements. General Electric Co.

145 Heating System—Illustrated Bulletin 548, 12 pp., discusses the merits of manufacturer's heating and drainage system for users of heat processing equipment, a system planned to increase speed of production, decrease maintenance and save fuel. It presents five industrial case histories in which installation of this system brought about gratifying increases in production. Operation of the system is described and illustrated with a diagram of an installation. Fred H. Schaub Engineering Co., Inc.

CORROSION PREVENTIVES, INDICATORS

146 NDHA Corrosion Tester—This 12-pp illustrated letter-size booklet describes this famous corrosion tester in detail, tells why and how it is used. The tester contains three coils and is supported in a pipe or other enclosure to where amount of corrosion is to be determined. Springs are weighed on installation and again after suitable period of exposure to full operating condition. Loss of weight can then be evaluated in terms of corrosion. Various metals used. Bulletin contains full discussion of use, results under various conditions, typical examples. Water Doctor Laboratories.

147 Chemicals for Metals—Here are 4 pp of information about manufacturer's products for the protection of metal surfaces, particularly a non-inflammable solution developed to remove rust chemically. Folder tells how this solution works and how it should be mixed and applied; discusses jobs for which it is especially suited and explains why it is economical to use. Also describes a rust preventive for indoor applications, and a heavy-duty rust preventive for outdoor use, as well as an acid-repellent plastic coating. Lists prices and gives coverages. Service Industries.

148 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a 4-pp folder covering a recently developed amine treatment for inhibiting corrosion of boiler and condensate systems. This is described as affording surface protection of the metal itself as well as raising the pH value of the condensate. Booklet gives specific case histories and typical economies obtained by using this treatment. Includes graphs showing relationship between free CO_2, pH and alkalinity in water, and solubility of oxygen in water when exposed to air at various pressures. The Bird-Archer Co.

149 Corrosion Preventive — This 4-pp folder on a Vinyl plastic coating emphasizes its value in combatting corrosion of metal, wood, stone, brick and concrete by atmospheric and chemical action. It discusses the characteristics of this preventive, tells how to apply it, recommends applications, and lists substances by which it is not affected. Also describes an underprimer. Dennis Chemical Co.

PUMPS, FANS

150 Sand and Gravel Pumps—Heavy-duty precision pumps in 1000 to 3000 gpm capacities for handling sand and gravel are described in this 4-pp bulletin. It contains photos and descriptions of all working parts and a sectional drawing to illustrate pump's operation. Specifications, dimensions. Kansas City Hay Press Co.

151 Lungs for Industry—Industrial fans for blowing, heating, cooling, conveying, aerating, separating or agitating are described in this bulletin titled "Lungs For Industry." Each of the many units cov-

YARWAY
IRON
Easy
TO SERVICE
• A good strainer protects your equipment and pipelines.
Maintenance men said "give us a strainer with a blow-off cap that comes out easily and makes up tight; a screen that can be put back in place without a lot of fiddling around".
• The easy-to-remove Yarway cap meets these requirements. It has straight (not tapered) thread, machined face and spark-plug-type gasket. Permits easy removal for cleaning. Insures proper screen alignment when replaced in body.
• Screen itself is of high grade woven monel wire, or perforated if desired.
• Body of strainer is iron or steel, cadmium-plated for protection against corrosion and for better appearance.
• Available in six sizes, ½" to 2", for pressures to 600 lbs. Reasonably priced. Hundreds of thousands in use. Stocked and sold by 150 Mill Supply Houses.
• See your dealer or write for Bulletin S-201.
YARNALL-WARING COMPANY
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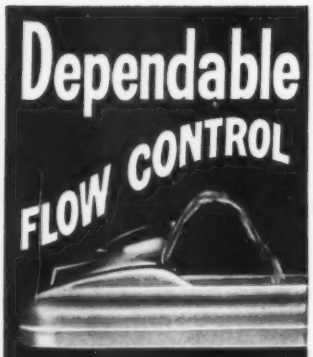
YARWAY STRAINERS
"Police the Pipelines"



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TEMPRITE
DRINKING WATER COOLERS

1. Dependable, automatic flow-control does away with spouting and splashing. No annoying water fluctuations. **2.** Smart, streamlined styling blends harmoniously into all surroundings. **3.** Effortless finger-tip pressure produces a steady stream of perfect-temperature drinking water. **4.** Temprite bubbler design gives maximum sanitary protection.

User Protected by 5-Year Warranty Plan

All models meet requirements of the National Bureau of Standards and Underwriters Laboratories, Inc.

Write for name of distributor in your neighborhood.

Manufacturers of water cooling equipment since 1928.

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ered in the catalog are well described and illustrations are presented. One section describes performance and efficiency tests. General Blower Co.

TOOLS, WELDING

152 Pipe Tools Catalog—Plant engineers wanting a good reference book on pipe tools will find one in this 52-pp catalog covering pipe tools and power machines. All tools listed are described as to their construction and application and illustrated by photographs. Capacities and sizes are given, and instructions are provided where necessary. The Toledo Pipe Theading Machine Co.

153 Safety Tools—Catalog 119 contains 28 pp and a heavy paper cover. Safety tool facts and a section on "How to Buy Safety Tools," present handy general information. The book is well-indexed. The tools covered include nearly every type from claw hammers and putty knives to hand saws and adjustable-end wrenches. Ampco Metal, Inc.

154 Rivet Demonstrator—This cardboard "pull tab" demonstrates the operating principle of manufacturer's one-piece blind rivets with inside threads. It also lists the advantages obtained by using these rivets and some typical applications. Illustrated by sketches. The B. F. Goodrich Co.

155 Inert Gas Welding—Here is a 13-pp article covering the practical aspects of inert-gas-shielded arc welding, including a discussion of the process, gases used, electrodes, straight vs reversed polarity, a-c and d-c equipment, control of gas flow, and techniques for different metals. It is illustrated with photos and includes tabular data on tungsten, stainless steel and aluminum. Air Reduction Sales Co.

PLANT SAFETY

156 Abrasive Paint—The three main features of this non-slip abrasive paint—application, adaptability, economy—are discussed in detail in this recently issued Bulletin 3-1. Additional features such as coverage, and descriptions of typical installations in which the paint may be used are covered. It can, the bulletin points out, be used to control dangerous slipping problems inside and outside plants and buildings. Frost Paint and Oil Corp.

157 Stainless Steel Extinguisher—This 6-pp folder completely describes the company's steel fire extinguisher of the foam type. Features such as its lighter weight, lower cost, dent resistance are stressed. The Fyr-Fyter Co.

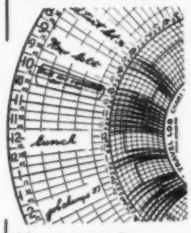
158 Protective Work Gloves—Natural rubber, plastic, and "Neox"-coated work gloves for industrial use are pictured and described in this 12-pp pocket catalog. Styles covered include knit-wrist, gauntlet and safety-cuff—with palm coated only, or coated all over. Contains a handy, comparative wear qualities chart to aid in selecting the type of glove best suited to working conditions. Edmont Mfg. Co.

MISCELLANEOUS

159 Radioactive Tracers in Industry—A 13 page bibliography on the industrial uses of radioactive tracers. The bulletin has a short introduction discussing the field of application, the Atomic Energy Commission requirements for use and general notes on the technique. The bibliography is divided into several sections covering general background references, industrial applications and applications to specific fields. Many references to fundamental research work have been omitted in order to concentrate on the work of known industrial significance. Arthur D. Little, Inc.

160 Call System—Six-pp Bulletin 4B describes a call system involving a numerical code sounded in audible signals. It lists the system's advantages and features and includes photographs of the button-operated transmitting mechanism. Tells how system can be handled by the switchboard operator to locate a person who fails to answer his phone. Clever sketches show how the call system "hunts" the missing person throughout the plant, by means of chimes, bells and whistles, making it possible for him to take the call on the nearest phone. Signal Engineering & Mfg. Co.

DOWNTIME REDUCED
from 15% to ½ of 1%



on a packaging machine with . . .

PE-KA TRAVEL LOG

Many companies now use the PE-KA TRAVEL LOG to provide an easy-to-read and accurate record of the activity of production machines, commercial or industrial trucks.

It tells the whole story of the minute-by-minute operation of the machines or vehicles—what happened and why. It insures proper operation of equipment—even when the superintendent is not there to oversee things. It helps you get better production with less spoilage.

The TRAVEL LOG acts as an automatic supervisor to insure maximum production. It records productive activity and idle time of machines or vehicles. The operator notes the reasons for idle time and other pertinent information.

Write today for descriptive bulletin; find out what PE-KA TRAVEL LOG is saving on industrial machinery like yours.

KNOPF INSTRUMENT CO.

250 Culver Avenue, Jersey City 5, N. J.

161 Speed Reducer Bulletin—The reasons why manufacturer's speed reducers give dependable, quiet operation are explained in this 4-pp booklet, illustrated with photos of several models. It tells what is necessary in the selection of a reducer and includes photos showing parts and a table giving typical examples of overhung load capacities. Winfield H. Smith Corp.

162 Maintenance Manual for Hydraulic Devices—Titled, "The Facts of Life on Air and Hydraulic Devices," this 18-pp pocket-size booklet (Form 16) presents the "do's," "dont's," and "what to look for" phases of setting up and servicing this type of equipment. It deals with air and hydraulic valves; air, hydraulic and airdraulic cylinders, hydraulic power units, and lines and power chucks. The Logansport Machine Co., Inc.

163 Iron Alloy Data—Bulletin 113, 12 pp, is filled with excellent information on two high silicon iron alloys, tradenamed Duriron (the original alloy) and Duriclor (a modification with increased resistance to hydrochloric acid). Gives chemical composition of both alloys as well as their mechanical and physical properties. Discusses available castings, their application, handling and maintenance, and welding. The resistance of these alloys to hydrochloric acid and sulphuric acids is explained and their resistance to many other corrosive materials is described. The Duriron Co., Inc.

CLASSIFIED ADVERTISING

EQUIPMENT FOR SALE

FOR SALE—5-hp GE mod. 402915 Type KT-955 Motor, 3 phase—440-220 volts—60 cyc.—1750-1160-855-590 rpm. Has been used on laundry flat ironer. Is in good condition and will sell reasonable. Children's Memorial Hospital, 707 Fullerton Avenue, Chicago, Ill. Phone DI 8-4040—Johnson.

Plexiglas in Building

(Continued from page 31)

Formed skylights, produced by softening the material with heat and blowing it into curved shapes similar to aircraft enclosures, have proved popular for certain types of applications.

Lighting Applications — There is a definite trend toward "engineered" lighting — a system of illumination that is planned as an integral part of the building itself. This plastic has many applications in such lighting systems. An excellent example is found in the case of a utility company which recently installed a luminous ceiling in a control room to provide glareless and shadowless illumination over the rows of instrument dials and controls.

Electric Drives

(Continued from page 38)

to lay down specific rules covering their care and maintenance. Specific instructions covering a particular type of coupling must be from the manufacturer. In general, however, couplings must be securely fastened and aligned on the respective shafts of the motor and the driven machine. Both halves of the unit must be in alignment on the horizontal and vertical axis of the coupling face. Float of the motor shaft must be centered as described for V-belts. Worn parts should be promptly replaced or repaired.

5. **INSPECTION—Load Test**

a. **Voltage, amperage, wattage and power factor**—Check the voltage at the motor terminals under normal load. It should not be below nameplate specification. An increase of 2 or 3 per cent above the nameplate specifications is not undesirable. Where load conditions of motor in question is normal, a spot check with a tong ammeter is ordinarily sufficient. This is also true of the power factor meter.

If indications are that the load is in any manner abnormal, obtain a graphic record of amperes and watts and in some cases voltage. Not only does this yield all motor load characteristics, but, in addition may be the basis of valuable information to be utilized by the Time Study Department.

DC Motors and Generators

Note: Inspection procedure for this class of equipment involves all the foregoing with the addition of the following:

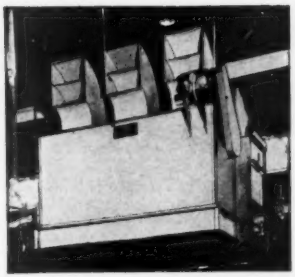
6. **INSPECTION**

a. **Brush Gear** — Carefully check brush gear for geometric spacing and alignment with the neutral commutating position. Brush holders should be checked for clearance with the commutator, that is, the distance from the bottom edge of the brush to the commutator. This will vary from $\frac{1}{8}$ to $\frac{3}{8}$ in.

New HIGH PRESSURE STEAM Fan Heater

Gives Savings You Never Had Before

The first heater to make High Pressure Steam really trouble-free and practical in plant heating. Every engineer should understand its original method; write for Niagara Bulletin and performance data.



HOW IT OPERATES: — A dual coil system makes use of all heat, both sensible and latent. High pressure steam enters the upper coil, shown on the diagram below. Its condensate drains into a trap. Then this high pressure condensate is released into the header of the lower coil. It instantly flashes into steam at vapor pressure.

Any high pressure condensate that remains liquid is carried to the vapor condensate return header by a drain tube that also gives off its heat into the air stream.

The vapor condenses in the lower coil. Its condensate is kept at a high level in the return leg by a wier in the return header so that all its heat is made useful and it is sub-cooled by contact with the coldest air entering the heater. Vacuum condensate return to boiler is vapor free.

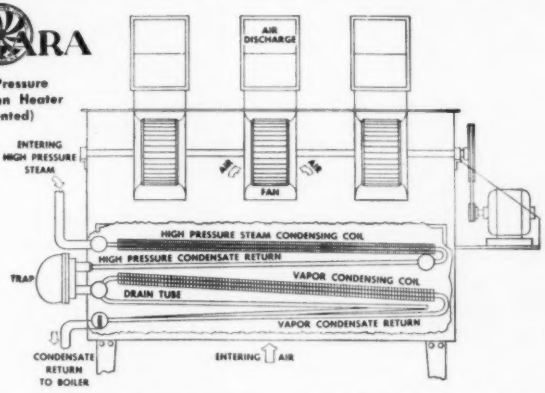
HOW IT SAVES IN COST: — Piping is much simpler and less costly than in low pressure systems. Much secondary piping, traps and big valves are not needed. Pipe sizes are smaller.

HOW IT SAVES IN OPERATION: — Waste is prevented. Every BTU goes where you want it. No dump traps or hot wells waste live steam.

HOW IT SAVES IN UPKEEP: — Condensate flow is even, vapor free, easily handled. No sudden surges of condensate in starting. No hammering, no hard wear and tear on system. Properly engineered for the job, final air temperatures are not excessive; heat easily directed where needed; no flashing of low pressure condensate. Heaters are self-draining on shut-down. Heaters are strongly built; all coils including the condensate drain tubes are hairpin bend, stress relieving. Use thru four heating seasons has proven these advantages in large scale plant heating.

NIAGARA

High Pressure Steam Fan Heater (Patented)



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Dept. PE, 405 LEXINGTON AVE., NEW YORK 17, N. Y.

Please send Bulletin 109 on the Niagara High Pressure Steam Fan Heater.

Name .....

Address .....

The 7-Range Clip-On Volt-Ammeter

FERRANTI

Offers These Important Advantages

- Measures up to 1000 amps—up to 600 volts.
- Convenient ONE HAND operation trigger action.
- Thumb operated range selector switch.
- 7 ranges—5 current and 2 voltage.
- Insulated core—shockproof construction.
- Takes cables up to 2¼" diameter.
- Distinct calibrations—easy to read.
- Suitable for 50-70 cycles.

RANGES 0-10 amps; 0-25 amps; 0-100 amps; 0-250 amps; 0-1000 amps; 0-150 volts; 0-600 volts

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ISLAND'S

LIGHT DUTY BELT CONVEYOR TABLES

PROBLEM—To save manual labor in toting finished clocks from the assembly table to the upper floor for testing and packing. Presently done by elevator and hand trucks.

RESULT—Installed ISLANDS Light Duty Table and Belt Booster thus saving up to 50% in manual labor and increasing production 25%.

ISLAND EQUIPMENT CORP.
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STOP LEAKS!

Quickly put on under pressure, without shutdown, Skinner-Seal Pipe Joint Clamps stop leaks at joints. Other clamps for other pipe leaks. Quick. Simple. Lasting repair. Write for catalog.

M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

depending upon size of the machine. Follow specific instructions covering particular machine in question.

Brushes should be of proper material to insure the correct balance between a slight or almost imperceptible abrasive action on the commutator. This insures cleanliness and provides the slightest degree of graphitic lubrication. The cross section and resistance of the brushes should be such as to carry the current without heating.

Brush tension should be just sufficient to insure good contact and freedom from chattering or jumping. Spacing on the transverse axis should eliminate tracking. That is, all portions of the commutator from the extreme inside to the outside should be covered by the brush faces in order to prevent wearing of grooves in the commutator face.

b. **Commutator**—Surface of commutator should be smooth and concentric. Mica should be kept thoroughly undercut. Check the junctions of coil risers to commutator segments and make certain that all contacts are secure. Check commutator end clamping rings to make certain segments are securely clamped.

Controls—AC and DC

1. **TESTING—Insulation**

a. **Coils**—Check all solenoids and transformers with a Megger or otherwise as stated under Motors 3a.

b. **Cleaning Windings**—Clean all windings and coils, if necessary, as described under Motors 1b.

c. **Dry Windings**—Dry out all windings and coils if necessary.

d. **Repair of Windings**—Repair insulation where and if needed, same as described under Motors 1e.

e. **Insulation Varnish**—Dip or spray windings when necessary as described under Motors 1b.

2. **INSPECTION—Mechanical Features**

a. **Contacts**—Check all contacts for contact pressure, alignment and surface. Surfaces must be free from all teats and nubbins, must be filed perfectly smooth and present at least 80 per cent of contact to its mating member.

b. **Mechanical Action**—Lever, roller, and cam action must be positive, smooth and with the joints free from excessive lost motion.

c. **Terminals**—Terminals must be tight and contacts must be such that no heating is in evidence.

d. **Relays**—Due to the variety of relays employed, it is impossible to lay down specific rules for their inspection and servicing. Consult instructions for specific equipment. In general, instructions for checking and servicing relays are similar to those given for controllers, with the exception that calibration must be carefully checked.

e. **Cases**—Cases or covers should be carefully checked to make certain that fastenings, hinges, latches, interlocks are in working order. This is especially important where safety interlocks are used for many accidents have been traced to the failure of such devices to operate at the proper time.

POWERS

DIAL THERMOMETERS

Help Cut Costs—

For more accurate temperature readings and improved efficiency use POWERS Dial Thermometers. They're vapor pressure actuated. Have 4" dials with either rigid stem for use in pipe lines and tanks or flexible tubing type for conveniently showing the temperature at a remote point. (DT)

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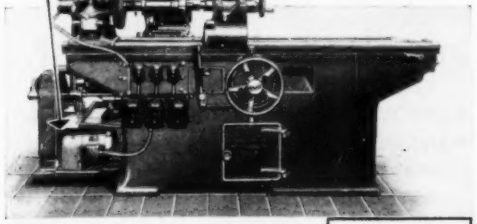
LIMA

meets specific motorization needs

The Landis Universal Grinder illustrated has been equipped with two LIMA "Multi-speed" Gearshift Drives and one LIMA Motor to meet a specific need for both constant and selective driving speeds. This is but one of many motorization problems solved by the combined use of Lima Drives and Lima Motors. Lima units are used extensively on special applications and by Original Equipment Manufacturers as integral driving mechanism of new machinery.

If you have a drive problem, why not consult Lima Engineers; their wide experience in machinery motorization can help to solve your problems. Write today for address of Lima's Engineer closest to you—he will be glad to assist you.



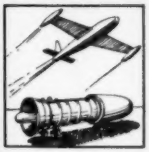
REPRESENTATION IN MOST PRINCIPAL CITIES

THE LIMA ELECTRIC MOTOR CO.
2095 FINDLAY ROAD, LIMA, OHIO

LIMA GEARSHIFT DRIVES
LIMA ELECTRIC MOTORS
LIMA PEDESTAL GRINDERS

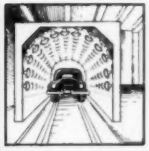
Silicone RUBBER PARTS

FOR EXTREME HIGH AND LOW TEMPERATURE APPLICATIONS



Silicone rubber parts are playing an important role in aviation today because they will withstand temperatures ranging from −160° to more than 500° F. In many cases, silicone rubber is bonded to metals to form a perfect seal.

Silicone rubber is recommended for use in automotive applications because it will not deteriorate from the chemical action of hot lubricating oils. In fact, sealed silicone rubber gaskets are improved rather than destroyed by hot oils.



Silicone rubber frequently is used to replace metal constructions forced upon design engineers by the limited thermal stability of organic rubbers. It also remains unaffected by long exposure to extreme heat and has excellent dielectric properties.

Silicone rubber tubing can be used to handle Freon, sulphur dioxide, and liquid ammonia in refrigeration systems. It retains its rubber-like qualities and will not become brittle at −160° F. Silicone rubber also remains unaffected by prolonged weathering.

Silicone rubber parts are resistant to ozone, tricresyl phosphate, and the chlorinated hydrocarbons used in liquid cooled transformers. They also are recommended for use in X-ray, radio, radar, television, and other types of electronic equipment.

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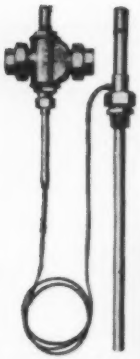

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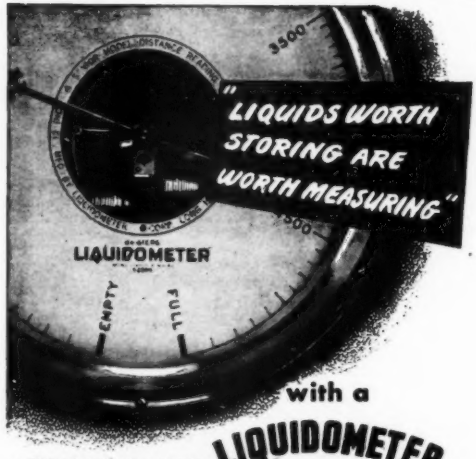

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ATOMICS

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IN SEPTEMBER, 1945, less than a month after the atomic bombs were dropped on Hiroshima and Nagasaki, we published the first full-length article on atomic energy. While the actual announcement of the success of the atomic bomb was as much of a surprise to us as it was to everybody else, we were, nevertheless, very much aware of its implications—some of our editors had been interested in the subject of nuclear energy for a great many years.

Recognizing the tremendous importance of atomic energy to the human race, we immediately laid plans for covering the subject for the benefit of our readers and in October 1945 we inaugurated the "ATOMICS" section in *Power Plant Engineering*. That was over 3½ years ago. Since that time, the ATOMICS section has appeared regularly in every issue and interest in it has grown month by month, year by year. Without exception, more articles on the technical and engineering aspects of atomic energy have appeared in the ATOMICS section of POWER GENERATION than have appeared anywhere else. ATOMICS was the first regular publication of its kind in the entire field of technical publishing. It antedates all other regular publications dealing with nuclear reactions.

More than 50 articles of major importance on atomic energy and its applications have appeared since the section was launched. These articles have all been of a practical, understandable character, written for engineers, not nuclear physicists. Material of this type has appeared nowhere else. It has constantly been the aim of the editors to translate the complex, highly technical material issuing from the laboratories into language that the average engineer can understand.

As a consequence of this policy, the articles that have appeared in ATOMICS have gained unusual acceptance; the demand for reprints and back numbers of the magazine has been so heavy that stocks have been exhausted within a month or two after publication. A considerable portion of this demand has been from industrial laboratories and from the plants operated under the U. S. Atomic Energy Commission.

Because of this steadily growing interest in atomics and the important developments that the AEC is planning, we have decided to expand ATOMICS and to publish it as a separate publication. Beginning with the June issue it will appear as a new journal.

In its expanded form it will be of interest to all who are in any way concerned with or interested in the technical and engineering aspects of nuclear power as well as to those interested in industrial, biological, and medical applications of nuclear reactions. Its down-to-earth character will not change, however. There will be articles of timely interest to those concerned with industrial process control; atomic power development will continue to receive major attention; there will be educational articles giving basic information to those who need to start from the ground up. The new ATOMICS will contain an Atomic News Section, presenting timely information regarding new developments. Also, it will contain a Book section listing books and other publications on atomic energy.

Beginning with the June issue, we will present a complete course in Nuclear Power Engineering. This will begin at the beginning—with a clear-cut consideration of the structure of matter and following through, each month, with chapters on methods in nuclear physics, neutron physics, nuclear chain reactions and finally, the design and construction of nuclear reactors.

In short the new ATOMICS will provide complete technical and news service to all who are interested in atomic energy in its more practical aspects.

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Records For Inventors *

HOW TO KEEP INVENTION RECORDS by Harry Aubrey Toulmin, Jr. Size 5½ by 8 in.; 78 pp. Second edition, reprinted by Research Press, Inc. Price $2.50.

IF YOU ARE in the process of marketing a patent, or if you plan to apply for a patent, this book will show you how to protect your patent property by keeping records which will prove your rights. These records include among others, the date of conception, date of disclosure to others, reduction to practice by test and experiment, proof of ordering materials for your first-run production.

Elementary questions such as "what is the difference between a patent, design patent, or trade mark?" Or, "when are photographs to be used?" Or, "What records are necessary to prove the date of conception?" are answered fully. The author of this book has been a trial lawyer for many leading corporations. The records are based upon his practical trial experience in the United States Patent Office and the United States Courts and his industrial experience as an executive and director of various manufacturing and research organizations.

Long Distance Instrumentation *

PRINCIPLES AND METHODS OF TELEMETERING by Perry A. Borden and Gustave M. Thynell. Size 6 by 9 in., 230 pp. 106 illustrations; cloth bound. Published by Reinhold Publishing Corp. Price $4.50.

FOR THREE decades remote measurement of variable magnitudes has engaged the serious attention of engineers. This book discusses present day methods and equipment as it actually is found in various installations. The principal emphasis is on electrical methods of telemetering but there is one short chapter at the end on fluid telemetering, using air and hydraulic fluids.

The book opens with discussion of the fundamental principles of electric telemetering covering current or conductance, voltage, frequency, position and impulse systems. Carrier current telemetering is described in some detail and there are chapters on coordinating, totalizing, computing, and integrating and on selection and application of telemetering systems.

The book is practical in its discussion of the operation and application of the various types of equipment and is non-mathematical.

Mechanical Vibration *

ELEMENTS OF MECHANICAL VIBRATION by C. R. Freberg and Emory N. Kemler. Size 6 by 9 in.; 228 pp including index. Published by John Wiley & Sons, Inc., second edition. Price $3.75.

THIS BOOK WILL serve plant engineers as an excellent source of reference on vibration problems. Written and edited primarily as a text book the volume deserves a place on the plant book shelf because of its excellent problem and answer sections at the ends of the chapters.

This second edition is distinguished by the addition of two new and important chapters: Sound and Beams. The increased emphasis given, in industry, to noise elimination led to the inclusion of the chapter on sound and its engineering applications. Since beams are a very common structural element they have been given added emphasis by combining previous discussion with new material.

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(Continued on page 66)

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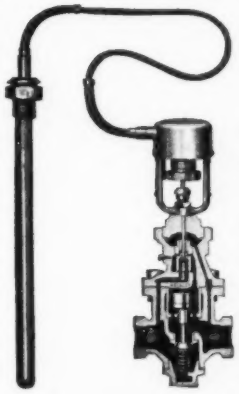

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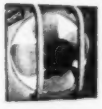

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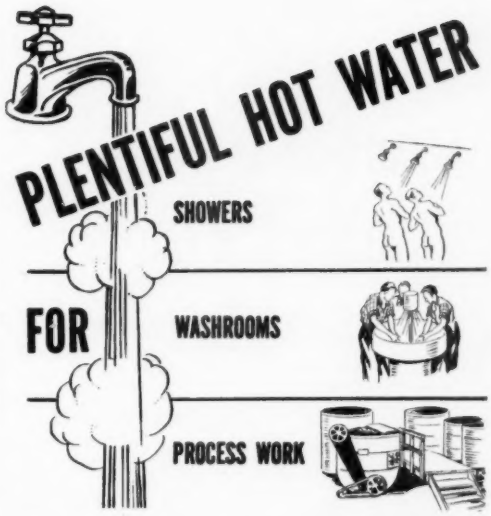

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(Continued from page 62)

of problems from a basic analysis. It also offers an uncomplicated mathematical notation, simplified yet adequately detailed explanation of the more elementary phases of vibration, plus methods and formulas to use and directions for using them.

All About Steam *

POWER AND PROCESS STEAM ENGINEERING by Douglas Copp. Size 5½ by 9 in., 174 pp with 99 illustrations; cloth binding. Published by Longmans, Green & Co., Inc. Price $3.75.

IN THIS BOOK the author describes why steam is an efficient method of turning heat into mechanical energy and how industrialists can get that heat out of it and use it. He discusses methods of simultaneous generation of power and process steam. Then come chapters on the use of steam for process and heating; generation of power by steam; planning a new installation; choice of steam generating plants; back pressure and extraction engines and turbines; the improvement of existing installations; maintenance of the efficiency of steam raising and utilizing plant; and finally, electrical principles and maintenance of electrical machinery.

Chapter V on the methods of preparing power process schemes is an exceptional section of the book. We know of few places in the textbooks, even in the United States, where you will find material on planning a new installation in just this form. Plant engineers or industrial power engineers will find their own particular problems treated here without reference to the problems of the utilities.

Inventor in the House? *

PATENT LAW FOR THE EXECUTIVE AND ENGINEER. By Harry Aubrey Toulmin, Jr. Size 5½ by 8 in.; 232 pages; colth bound. Reprinted by Research Press, Inc. Price $2.95.

THIS book is an essentially practical treatise on the correct procedure for getting a patent. Not only does it serve as a guide for the individual inventor, but it also tells company management how to stimulate invention by employees, how to avoid patent infringement, and how to protect research profits.

In the very first chapter of this book, the author has summarized the advantages to the American system of the patent monopoly, "the only monopoly approved by the United States Government." In brief form, he discusses the step-by-step procedure of patent application and describes the advantages and privileges of the patent holder. The services of a patent attorney are described and the author points out just when to consult a patent attorney. Furthermore, he discusses the relative merits of protection by trade secret or patent. Discussed in considerable detail is one of the little known phases of patent protection—the ability to prove that certain events happen on certain dates. The successful prosecution or defense of a patent suit often depends upon properly kept invention records.

For Diesel Engine Men *

DIESEL ENGINEERING HANDBOOK. Size 6 by 9 in.; 962 pp, illustrated; 1946-1947 edition; cloth bound. Published by Diesel Publications, Inc. Price $5.00 U. S., $6.00 elsewhere.

THE SIXTH edition of a popular handbook dealing with the Diesel engine and its many applications. The principal revisions are in style, mathematical presentation, and the inclusion of new developments in engines, accessories and applications. The book is descriptive and non-mathematical. In addition to a comprehensive treatment of engines, component parts, accessories and related equipment, there are advertisements by manufacturers of Diesel engines, accessories and auxiliaries, and discussions of installation and maintenance details.

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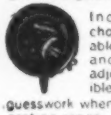

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Recommended wherever quiet and dependable performance are essential. Various types available.

MERCOID FLOAT CONTROLS

Used for maintaining fluid levels in tanks or for control of sump pumps, etc. Two types, the counter-balance type and plunger type available.

All Mercoid Controls are equipped exclusively with mercury switches—assuring better control performance and longer control life

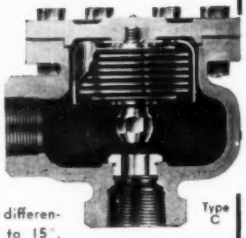
THE MERCOID CORPORATION
4227 West Belmont Avenue, Chicago 41, Illinois

MANUFACTURERS OF AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND NUMEROUS INDUSTRIAL APPLICATIONS. ALSO MERCOID BRAND MERCURY SWITCHES.

Nicholson Steam Traps

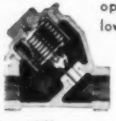
STOP BACK-UP of CONDENSATE

Operate on Lowest Temperature Differential

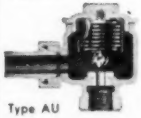


Type C

Repeated comparative tests by large trap users show that Nicholson traps operate on lowest temperature differential: 5° to 15°, depending on trap size and steam pressure. Plant records show that, by preventing back-up of condensate, they have increased production of cooking kettles as much as 30%. Also prevent corrosion or damage to thin gauges. 5 types for every application. Size ¼" to 2"; press. to 225 lbs. BULLETIN 1047.



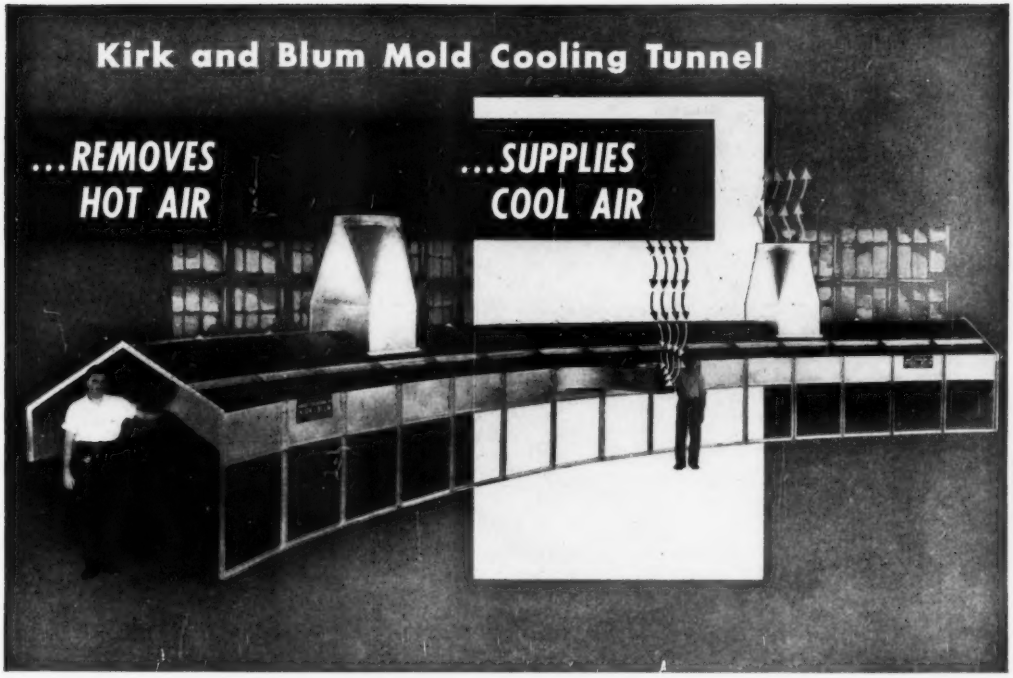
Type AHV



Type AU

W. H. NICHOLSON & CO. 208 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties



SOLUTION to the problem of efficiently cooling castings and at the same time, removing hot air, is illustrated here in the plant of National Malleable & Steel Castings Co., Indianapolis, Ind. The "quarter-circle" of hood is supplied with a built-in duct which supplies cool air all along the mold cooling conveyor. This air, drawn from outside the foundry, picks up heat from the castings and is then exhausted outside the building. The hood is supported on just one side so there is minimum interference with trucks on the "aisle side" and cleaning is made easier.

Engineering ingenuity such as this is just one reason why plants . . . large and small . . . in every industry depend on KIRK & BLUM for efficient cooling and dust and fume collection. The 40-year store of experience behind KIRK & BLUM engineering, fabricating and installation service is yours to command; refer your air-handling problems to KIRK & BLUM.

Designed, Fabricated and Installed by Liberty Engineering, Div. Kirk & Blum, Indianapolis, Ind.

FOR CLEAN AIR . . . THE [redacted] TOOL

KIRK AND BLUM
DUST AND FUME CONTROL SYSTEMS

THE KIRK AND BLUM MANUFACTURING COMPANY
2889 Spring Grove Ave. • Cincinnati 25, Ohio

Announcing BULLDOG "Pushmatic"

NARROW COLUMN ELECTRI-CENTER

Push-Button Control with Automatic Protection

SIMPLE, compact, attractive . . . the *Pushmatic* Narrow Column Panel, featuring *Pushmatic*, offers versatility and adaptability never before obtainable in any panelboard.

You'll be surprised at the ease of installation and operation made possible by the use of simple, compact *Pushmatic* circuit-breaker units.

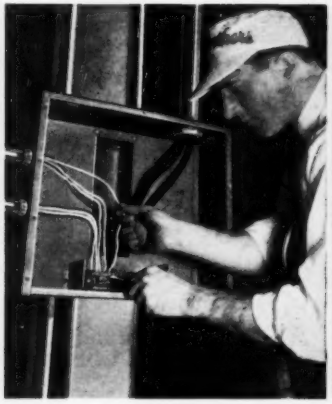
And it's easy to wire! Installation time is cut to a minimum. The wireman pulls the heavy main cables and branch circuit wires into place in the cabinet before the panel is mounted. He works quickly and surely because there is nothing to block his vision or cramp his movements.

There are four types of *Pushmatics:* THERMAL ONLY, THERMAL-MAGNETIC, or either of these types with AMBIENT COMPENSATING FEATURES. All *Pushmatics*, regardless of rating or type, are identical in size and contour and are interchangeable. Narrow Column Panels can be ordered with any combination of *Pushmatic* types or ratings (15 A. to 50 A. 120/240 V. AC).

The actual installation, pictured below, could have been done just as easily and quickly in your own plant. Send the coupon today for *Pushmatic* Bulletin #493. It will answer all your questions about prices and specifications.

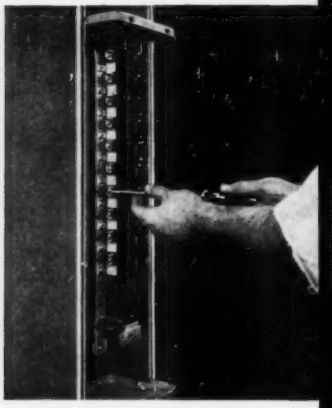
WIRING IS QUICKER AND EASIER WITH THE *Pushmatic* NARROW COLUMN PANEL

1 After installing the light rear halves of the cabinet and riser section, the wireman pulls the main cables down and connects them to the main lugs, easily and quickly.



2 He makes his neutral connections in the Pull Box near the ceiling, saving the conduit and wire he would have used had they been made in the panel below.

3 In plain view he brings the branch circuit wires down into the cabinet, pulls them through the holes in the wire retainer and skins them ready for connection to branch Pushmatics.



4 The light cabinet interior is then set in place in front of the wires and cables. Having already aligned the branch wires with the Pushmatic breakers through the wire retainer, he simply inserts the wires in the solderless wire grips and tightens the pressure screws.

PUSH **It's ON**

PUSH **It's OFF**

PUSH **It's ON again**

Positive finger-tip control and automatic protection against short or overload are yours in the sensational, new *Pushmatic*.

Just a push of the finger makes or breaks the circuit. No resetting manually when the circuit is broken by short or overload. Just PUSH—and the electric service is restored.

Smaller than a pack of cigarettes, the *Pushmatic* is the most versatile and flexible unit available today.

Pushmatic is an individual single pole unit, eliminating complicated group mountings and making additions and changes a simple matter. And this smooth-operating unit is built for long life. Metal to plastic bearing surfaces prevent corrosion and sticking.

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Please send me *Pushmatic* Bulletin #493 giving full information and prices on your *Pushmatic* Electri-Centers.

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